

Government of Madras.

EDUCATIONAL DEPARTMENT.

Recd.

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Enclosures

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G.O. No. 112, 9th February 1912.

Dyeing Industry.

Passing orders on the report of Dr. Marsden regarding the state of the — in Southern India.

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GOVERNMENT OF MADRAS.

EDUCATIONAL DEPARTMENT.

READ—the following papers :—

I

G.O. No. 184, Educational, dated 29th February 1911.

ABSTRACT.—Approving the programme of work proposed for Dr. Marsden, the dyeing expert.

II

Letter—from K. T. B. TRESSLER, Esq., Acting Superintendent of Industrial Education.

To—the Director of Public Instruction.

Dated—Madras, the 22nd August 1911.

No—203 I.

I have the honour to forward herewith Dr. Marsden's report on the dyeing industry. Pending the issue of definite orders on the proposals already submitted by Mr. Chatterton regarding the proposed tinctorial laboratory in Madura, Dr. Marsden will have little to do in connection with his dyeing work.

2. I have discussed the matter with Mr. Chatterton and he suggests that Dr. Marsden should turn his attention for the time being to the preparation of artificial food stuffs. I accordingly request orders on this point.

ENCLOSURES.

Letter—from Dr. F. MARSDEN, Tinctorial Expert, Madras.

To—the Director of Public Instruction (through the Acting Superintendent of Industrial Education).

Dated—the 22nd August 1911.

I have the honour to forward my report upon the dyeing industry in the Madras Presidency according to G.O. No. 184, Educational, the terms of which were communicated to me by the Superintendent of Industrial Education in a note dated 5th April 1911, a copy of which I enclose.

Letter—from the Superintendent of Industrial Education, Madras.

To—the Tinctorial Expert, Madras.

Dated—the 5th April 1911.

I have the honour to communicate to you for your information a copy of G.O. No. 184, Educational, dated 29th March 1911.

2. Under the programme of work which has been sanctioned by Government, your first duty will be to make yourself generally acquainted with the conditions under which the dyeing industry is carried on in this presidency. Madras and Madura are the two principal centres of the industry, but it is also carried on in a small way in almost every large town. It will, I think, be convenient first to make a study of the industry in Madras and then proceed to Madura

afterwards visiting as many other centres as you may consider necessary in the course of your investigations. When you have acquired the necessary information, a report should be prepared explaining in detail—

- (1) how the industry is carried on at the present time;
- (2) in what respects the practice of native dyers is defective; and
- (3) as far as is practicable from a preliminary survey how it may be improved.

3. You will doubtless consider the question of establishing a school for dyers with an adequately equipped tinctorial laboratory and in dealing with this question, it will be necessary that you should discuss—

- (1) where the school should be located;
- (2) from what classes of the community you expect to obtain students;
- (3) the general educational attainments to be expected from the students and the necessity or otherwise for general chemical work; and
- (4) the character of the instruction to be given.

4. It will be desirable that you should indicate the nature of the accommodation that should be provided for the dyehouse and tinctorial laboratory, and a preliminary estimate of the cost of the same should be prepared.

In regard to this latter item, the plans and estimates may be prepared in my drawing office and the head draftsman will be instructed to render you any assistance that you require.

5. It should, I think, be possible for you to complete this preliminary survey and submit a report on the same within about three months.

Report upon the Dyeing Industry in the Madras Presidency.

1. In accordance with the terms of G.O. No. 184, Educational, dated the 29th March 1911, I have the honour to report that I have visited many, if not most, of the districts and towns in the presidency where dyeing is practised to any extent and have endeavoured to obtain, direct from the workers engaged in the industry, information as to the conditions under which it is carried on and the methods employed. I have dealt more particularly with the dyestuffs and the dyeing processes in use, and have not attempted to deal with the economic conditions in the industry, these being rather too complex to be understood in a few weeks by one who has had no previous experience of the people and their customs.

2. That the improvement of textile materials by imparting colour to them is of very ancient origin is well known, and it is most probable that the art was discovered, or became highly developed at an early period among the more cultured people of the east, and only slowly spread westwards. The oldest references to dyeing point to India, or the lands between India and the Levant being the birthplace of the art, and until quite recently the reputation of Indian fabrics stood very high. With a wealth of natural products possessed perhaps by no other country, it is not surprising that in India the dyers were able to produce effects superior to those yielded by the natural products at the disposal of people less favourably situated, but with the improvements in means of communication, and the growth of trade, the products not only of India but of the East and West Indies became available to the European dyer, and, in spite of legislation (often amounting to direct prohibition) intended to protect home-grown products from the competition of some of the imported tropical dyewares, the superiority of the latter was such that nothing could stop their extended employment.

3. In the commencement dyeing was a craft carried out on empirical lines, and it was apparently the development of the spirit of scientific investigation in the seventeenth century which led to attempts being made to discover the principles upon which the fixation of colouring matters by textile materials depended. The growth of the industry in Europe was assisted by the increase in the knowledge of chemistry and the general application of scientific methods in solving industrial problems, and it is due to this that dyeing and printing have there reached such a high degree of development. The effects of this development have not been felt in India until recently, except in the competition of the coloured products of Western looms with the indigenous cloths, and in the steady advance in the consumption of artificial dyestuffs, which has seriously restricted the demand for natural products.

4. It will not be out of place here to draw attention to the steady increase in the demand in the presidency for the so-called artificial dyewares, although no figures are available which would serve to show to what extent these synthetic products are displacing those of purely vegetable origin, which have hitherto been employed. I have also collected figures relating to the dyeing and tanning materials exported from the presidency but of these it is only indigo which may be considered as exclusively used for dyeing, and the figures are introduced here to give an idea of the diminution in the world's demand for this important natural product. I do not think it is possible to give any data respecting the consumption of indigenous products, but it is evident from the quantity of dyewares imported that the amount of dyeing carried out in the presidency must be considerable.

Extracts from Tables in Review of Sea-borne Trade and Navigation for the
Presidency of Madras, and the Review of Rail-borne Trade.

TABLE A.

Imports of dyeing and tanning materials from foreign countries.

Year.	Direct imports.			
	Alizarine.		Aniline dyes.	
	Weight.	Value.	Weight.	Value.
	LBS.	RS.	LBS.	RS.
1900-1901	1,298,717	5,90,671	100,848	1,25,825
1901-1902	755,264	3,81,895	132,442	1,40,687
1902-1903	992,264	5,13,229	141,208	1,48,178
1903-1904	1,115,739	5,58,790	155,635	1,50,108
1904-1905	941,159	4,93,836	148,601	1,40,267
1905-1906	1,121,599	5,44,740	195,530	1,41,869
1906-1907	943,583	5,05,640	173,397	1,43,301
1907-1908	1,330,926	7,83,861	229,841	1,81,516
1908-1909	1,268,032	7,72,671	209,494	1,77,846
1909-1910	1,381,635	8,49,949	266,296	2,20,266

NOTE.—It will be noticed that the weights of alizarine imported in 1900-1901 and 1907-1908 are almost the same, but that the value in the latter year is much greater. This is explained by the fact that alizarine is not imported in the "dry" form but as a homogeneous paste; it was usually produced to contain 20 per cent. dry alizarine, but improvements have made it possible to produce pastes of higher strength and "40" per cent. is now being more and more used.

TABLE B.

Foreign merchandise imported coastwise from Indian ports.

Year.	Alizarine.		Aniline dyes.	
	Weight.	Value.	Weight.	Value.
	LBS.	RS.	LBS.	RS.
1900-1901	254,364	1,12,041	107,941	1,63,859
1901-1902	556,498	2,68,912	147,304	2,21,432
1902-1903	351,048	1,86,788	78,110	98,027
1903-1904	399,452	2,19,205	50,432	70,510
1904-1905	450,288	2,39,861	53,189	58,554
1905-1906	406,168	2,13,777	49,103	71,099
1906-1907	316,288	1,70,713	75,428	88,186
1907-1908	182,756	98,119	34,900	42,996
1908-1909	167,748	91,128	20,325	20,488
1909-1910	203,446	1,09,896	32,091	36,056
1910-1911	167,366	90,198	47,430	50,478

TABLE C.

Rail-borne imports.

Year.	Alizarine and Aniline dyes.	
	Weight.	Value.
	LBS.	RS.
1900-1901	150,770	1,15,868
1901-1902	163,749	1,34,653
1902-1903	296,805	2,33,171
1903-1904	471,579	3,57,642
1904-1905	524,901	3,88,753
1905-1906	559,049	3,88,865
1906-1907	490,834	3,31,987
1907-1908	830,181	5,58,042
1908-1909	535,762	3,67,967
1909-1910	565,385	3,59,366

TABLE D.

Total value of alizarine and aniline dyes imported by sea and rail into the Presidency of Madras.

Year.	Value.
	RS.
1900-1901	11,10,264
1901-1902	11,47,479
1902-1903	11,79,393
1903-1904	13,56,255
1904-1905	13,21,271
1905-1906	13,60,300
1906-1907	12,39,827
1907-1908	16,61,534
1908-1909	14,30,100
1909-1910	15,75,533

TABLE E.
Indian produce exported (Dyes and Tans).

		Year.											
		1900-1901.	1901-1902.	1902-1903.	1903-1904.	1904-1905.	1905-1906.	1906-1907.	1907-1908.	1908-1909.	1909-1910.		
		Cwt.	Rs.	Cwt.	Rs.	Cwt.	Rs.	Cwt.	Rs.	Cwt.	Rs.		
												Value	Value
Cutch	..	57	1,311	109	2,564	216	5,219	189	4,325	154	3,631		
Indigo	..	18,940	25,400	32,242	49,13,604	24,414	11,901	16,85,409	17,71,691	2,940	7,756		
Myrabolams	..	39,25,851	49,33,525	49,13,604	38,39,663	38,39,663	16,85,409	11,56,349	120,793	121,123	192,356		
Turneric	..	137,777	107,426	113,012	96,534	106,004	121,123	198,508	3,48,649	5,08,774	4,43,606		
Total value of dyes and tans exported	..	3,99,668	2,35,598	2,34,277	1,96,929	5,41,401	5,05,578	2,94,216	19,550	29,958	31,519		
	..	17,542	39,272	39,272	21,009	17,542	1,08,724	1,77,469	2,07,044	2,81,042	2,77,357		
	..	16,665	39,272	39,272	21,009	17,542	1,08,724	1,77,469	2,07,044	2,81,042	2,77,357		
	..	2,21,714	1,98,597	2,65,967	1,16,959	86,663	18,37,833	23,13,259	22,91,091	15,90,030	13,58,237		
	..	54,41,572	54,41,572	54,80,252	42,29,971	23,85,927	18,37,833	23,13,259	22,91,091	15,90,030	13,58,237		

* In the Review of Sea-borne Trade and Navigation for 1900-1901 mention is made of the fact that the exports of indigo were less by 50 per cent. than those of the preceding year.

TABLE F.
Rail-borne exports from the Presidency of Madras.

	Year.																								
	1900-1901.		1901-1902.		1902-1903.		1903-1904.		1904-1905.		1905-1906.		1906-1907.		1907-1908.		1908-1909.		1909-1910.						
Alizarine and aniline dyes.	Weight	lb.	73,728	4,855	11,355	8,557	21,569	26,496	10,862	17,774	23,122	24,192	..	Weight	lb.	82,827	5,764	12,406	8,822	21,569	26,496	10,862	17,774	23,122	24,192
	Value	Rs.	82,827	5,764	12,406	8,822	21,569	26,496	10,862	17,774	23,122	24,192		..	Value	Rs.	39,333	7,251	11,603	5,755	11,603	5,755	11,603	5,755	11,603
Cutch. . .	Weight	lb.	39,333	32,421	53,650	51,017	59,739	40,485	41,833	86,646	232,869	42,706	..	Weight	lb.	187,035	2,98,062	3,03,400	3,03,400	3,03,400	3,03,400	3,03,400	3,03,400	3,03,400	3,03,400
..	Value	Rs.	39,333	32,421	53,650	51,017	59,739	40,485	41,833	86,646	232,869	42,706		..	Value	Rs.	7,251	6,755	11,603	5,755	11,603	5,755	11,603	5,755	11,603
Indigo . . .	Weight	lb.	187,035	237,723	218,057	498,980	630,967	319,515	667,749	490,587	363,456	467,647	..	Weight	lb.	2,98,062	3,41,756	3,03,400	3,03,400	3,03,400	3,03,400	3,03,400	3,03,400	3,03,400	3,03,400
..	Value	Rs.	2,98,062	3,41,756	3,03,400	498,980	630,967	319,515	667,749	490,587	363,456	467,647		..	Value	Rs.	1,040,670	422,290	308,242	8,237	8,149	6,755	10,46,835	7,69,358	5,39,979
Myrabolans. . .	Weight	lb.	1,040,670	422,290	308,242	307,584	729,710	740,325	245,787	166,672	314,414	192,278	..	Weight	lb.	2,561,472	3,65,932	1,842,789	1,817,609	904,978	4,513,207	2,767,515	8,071	2,947	
..	Value	Rs.	30,807	12,857	8,237	8,149	729,710	740,325	245,787	166,672	314,414	192,278		..	Value	Rs.	30,807	12,857	8,237	8,149	729,710	740,325	245,787	166,672	314,414
Tanning barks	Weight	lb.	4,66,487	3,65,932	56,409	42,104	20,926	58,456	1,28,066	99,302	87,859	77,322	..	Weight	lb.	8,504,969	12,440,037	12,245,513	7,289,198	8,425,975	13,863,714	18,02,139	33,345,084	29,009,088	
..	Value	Rs.	8,504,969	12,440,037	12,245,513	7,289,198	8,425,975	13,863,714	18,02,139	33,345,084	29,009,088	..		Value	Rs.	10,18,831	11,10,565	6,93,688	4,14,775	5,54,676	14,12,267	18,76,220	24,73,485	24,73,485	
Turneric . . .	Weight	lb.	630,555	421,951	404,352	267,749	402,048	462,034	5,07,867	372,507	542,427	626,935	..	Weight	lb.	630,555	421,951	404,352	267,749	402,048	462,034	5,07,867	372,507	542,427	626,935
..	Value	Rs.	63,998	33,769	31,799	14,593	14,593	14,593	14,593	14,593	14,593	14,593		..	Value	Rs.	63,998	33,769	31,799	14,593	14,593	14,593	14,593	14,593	14,593
Other sorts . . .	Weight	lb.	13,037,760	15,671,868	15,083,959	10,230,665	11,174,976	15,585,490	19,851,100	22,383,360	37,592,887	32,668,827	..	Weight	lb.	13,037,760	15,671,868	15,083,959	10,230,665	11,174,976	15,585,490	19,851,100	22,383,360	37,592,887	32,668,827
Total . . .	Value	Rs.	19,58,273	18,66,458	11,17,442	11,75,115	15,48,201	15,03,625	26,35,255	27,91,061	38,00,591	32,19,669		..	Value	Rs.	19,58,273	18,66,458	11,17,442	11,75,115	15,48,201	15,03,625	26,35,255	27,91,061	38,00,591

5. The dyeing industry is widespread, but is more in evidence of course in the neighbourhood of weaving centres. The dyers do not as a class appear well to do, the general type of dyehouse being small and badly lighted (very often it is part of the dwelling house) and the plant and apparatus employed in the majority of cases is exceedingly simple. In the small dyehouses for cotton, there is usually one round vessel (copper) of about 25 gallons capacity, set over a grate in which leaves, brushwood or wood may be burnt as a source of heat. The hanks of yarn are suspended upon sticks which rest upon the edges of the vessel, and from time to time the yarn is turned during dyeing, by inserting a thin stick in the bight of the hanks and altering the position on the supporting stick so that the yarn which was previously outside the liquor now becomes immersed.

The preparation of the yarn before dyeing is usually very simple and consists in steeping in cold water until thoroughly impregnated, the process often being accelerated by "beating," after which the excess of water is removed by wringing. Such a preliminary treatment is quite insufficient to remove the natural impurities of cotton and this is recognised in some of the better class dyehouses, where the yarn is boiled out in a solution of carbonate of soda, which is far more efficacious than water alone in removing the natural wax, colour and dirt. This preliminary boiling is of importance, as the more efficiently it is carried out, the clearer and more even are the shades subsequently dyed upon the yarn.

A type of dye vessel which is well suited to the dyeing of small lots of yarn is in fairly general use and consists of a rectangular vessel, some 45 inches long, 24 inches wide and 20 deep, set over a grate in brickwork and encased in cement. It is economical in space and permits, when not overloaded, of the yarn being efficiently worked in the dye liquor.

6. In the dyehouses under European control, that is in the mills, jails, and the Basel Mission Factory at Cannanore, the conditions of course are adapted to the work to be done, but in Indian dyehouses it was only in a few that the conditions and arrangements were at all suitable for handling any large bulk of material.

7. As was only to be expected, seeing that the dyeing industry here is so closely associated with that of weaving, it is chiefly in the form of yarn in the hank that fibres are dyed, but in Madras, Madura and other places, cloths are also dyed in the piece, or printed, and "reserve" effects are produced by knotting with thread the parts to be reserved (bandhana dyeing) or painting over with melted wax, and "ombré" effects by clamping the cloth and immersing only a part of it in the dye liquor.

The shades demanded, and dyestuffs used, vary according to the markets for which the material is intended and in towns quite close together the demands for the local trade may be very different. In one centre visited, special stress was laid upon the colours being fast, whilst in an adjacent town the trade demanded brightness of shade, and fastness was apparently of little moment. The question of fastness however is largely one of degree and may be—and is—differently interpreted by different people.

8. The smallness of the scale upon which the majority of the dyers work, the absence of capital and the lack of knowledge of the principles of dyeing and the treatment of fibres, make it a matter of difficulty to see how they can be moved to progress, and to adopt more modern and suitable methods; they apparently live from hand to mouth, with no reserve of capital to permit of their making any improvements which may be required in plant or buildings and above all there appears to be a general want of confidence between traders which precludes, I should think, the possibility of capital being advanced by outsiders. The standard of general education of most of the dyers interviewed was very low, their knowledge of dyeing processes did not extend as a rule beyond the possession of the empirical data required for the production of the shades which might be in demand in their immediate market, and in cases where outside competition had captured the market by supplying coloured yarns more suited to the trade, as regards fastness, properties, etc., they were at a loss to know how to regain their business. Their desires did not extend beyond "recipes" to assist them in carrying out the processes employed in the production of the better article, but that they themselves could make trials and gain information, even from failure to obtain the results aimed at, appeared to be quite foreign to their trend of thought. "Imitation" without any attempt at "initiation" is evident in all that is done, * the principles underlying treatment of fibres, and reasons for the different methods employed in the application of different classes of dyestuffs are quite unknown, and as there is never any interchange of ideas between dyers, each one is dependent upon what he has been taught by his father (or other member of his family) or upon what he gathers from travellers anxious to push certain wares. The general idea for meeting competition is not to improve the method or conditions of dyeing or the quality of the work, but consists rather in lowering the price, resorting to the use of inferior materials, or to methods of business which are still less to

* In drawing attention to the habit of blind imitation which is so evident among the dyers in this presidency it is interesting to speculate upon the effects it may have had in debasing the methods of dyeing handed down from past generations.

The originators of the processes must have obtained their information by observation and experiment, and slowly evolved working recipes which have been handed down, but I feel confident that much has been lost in the many transferences, for some of the processes (with wool especially) are irrational and do not tend at all to preserve the essential qualities of the fibre.

be commended. The lack of perception by purchasers of the difference between what is good and what is only poor value is responsible for cheapness being the deciding factor (and the question of quality becomes apparently but of minor importance), and it is little wonder that the quality of a lot of the dyeing done in Indian dyehouses is poor, for the prices paid in many districts do not permit of any but the lowest class work being supplied.

9. A prevailing fault in the people engaged in the industry is the assumption that the processes of dyeing are secrets. It is this idea which may be considered as largely responsible for the failure to progress; for without stimulus from outside or interchange of ideas, stagnation is all that can be expected and in isolating himself in order to preserve his "secrets," the dyer cut himself off from the only avenue for obtaining knowledge which was open to him. Each one seemed to think that his neighbour would learn something from him, but he failed to realise that it was possible for him to improve his own knowledge merely by the discussion of an every day topic, and that fresh lights are thrown upon a subject and a stimulus given to ideas by casual conversation with people engaged in the same industry. In the majority of cases it has been with the greatest reluctance that any information with regard to the methods employed has been given to me, and very often inaccurate or misleading replies were received when the questions put could not be evaded. The more ignorant the dyer, the greater appeared to be his idea of the value of his knowledge, but in Madura and other places where dyeing is carried on under better conditions, little difficulty was experienced, and information as to the processes and the dyestuffs employed was freely given.

10. In plain dyeing, it may be stated that there are no secrets, for the technology of the textile fibres is well understood and the dyeing process with almost all dyestuffs is comparatively simple. The complicated processes which are met with in India and which were in general use when natural dyestuffs only were available are traceable in the main to the difficulty in obtaining the chemicals required for developing or preparing the dyeware for dyeing. The variations in the recipes, or "improvements" by the dyer, were due to the variation in quality of the earths (dhubie's earth, etc.), ashes (wood ashes, kelp) and other substances employed; with pure chemicals at command, most of these intricacies disappear and any difficulty experienced in the dyeing with indigenous dyestuffs need only arise from the variable quality of the dyeware itself.

11. This question of the colouring power of the various natural dyewares is important and with products obtained at different times or from different places the dyer never knows until he has dyed his shade whether it is a "match" or whether he has not to repeat the operations with quantities which, according to his judgment, will bring the dyeing up to the shade required. The procedure is simple when the quality is poorer than usual, for the shade can be built up, but when by chance the shade comes out too full, the dyer is often incapable of stripping the excess of colour without damaging the material.

12. When visiting the various districts, I made special enquiries as to the places where indigenous dyestuffs were still in use, but with the exception of indigo it was only in isolated cases that the natural dyestuffs have withstood the competition of the imported artificial dyewares. In places in which a few years ago comparatively large quantities of natural dyewares had been employed, there was now no market for them, the dyers preferring the powder products of the European colour firms. I did, however, here and there see the operations with indigenous products being carried out, or interviewed dyers who only recently had given them up, to take to the use of imported dyewares.

The plant products which until recently were or are still in use are—

Turmeric (<i>Curcuma longa</i>).	Manjit (<i>Rubia cordifolia</i>).
Flowers of modugu tree (<i>Butea frondosa</i>).	Chay root (<i>Oldenlandia umbellata</i>).
Myrabolams (<i>Terminalia chebula</i>).	Nóna root (<i>Morinda citrifolia</i>).
Annatto (<i>Bixa orellana</i>).	Sooranje (do. do.).
Cutch (<i>Acacia catechu</i>).	Indigo (<i>Indigofera</i>).
Safflower (<i>Carthamus tinctorius</i>).	Kamela (<i>Mallotus Philippensis</i>).
Sappan wood (<i>Cæsalpinia</i>).	Laca (<i>Tachardia lacea</i>).
Semburam bark (<i>Ventilago Madraspatana</i>).	Jackwood (<i>Artocarpus integrifolius</i>).

13. *The Dyeing of cotton.*—Of the vegetable fibres, flax and cotton are probably those the manipulation of which was most readily mastered by the ancients, but whereas flax was grown in Europe, Egypt and China from very early times, it does not appear that it was ever cultivated in India for textile purposes. Cotton was apparently introduced into, and cultivated in Upper Egypt about 500 B.C., and all the evidence obtainable points to the fact that the plant was introduced from India where the cultivation and manipulation of the fibre had been understood from the very earliest times. The natives of Peru also appear to have been expert in the spinning and weaving of cotton; but although they possessed great skill in the dyeing of their woollen fabrics, cotton was either left undyed or dyed in but one or two colours. In India, on the other hand, the greatest possible variety of shade was produced not only in the way of plain

dyeing, but also in the production of fast colours by the application of mordants and by "reserve" and printing processes. The "reserves" were obtained, as in bandhana dyeing, by stitching knots, folds and creases in the cloth with thread, or by painting over the parts with melted bees wax, whereby the penetration of the dye liquor into these portions upon immersion in the dye bath was prevented, and the reserved parts appeared as a design upon the finished cloth.

These wax reserves were also applied with the assistance of engraved blocks of copper or wood, and mordants were printed upon the cloth by the same means, the colour being fixed only upon the mordanted parts when the cloth was subsequently immersed in the dye bath.

Such dyed cloths were known in Rome, but it was not until the discovery of the sea route to India that cotton became at all well known in Western Europe. The manipulation of the fibre was fairly well understood in the early part of the 17th century and the Honourable East India Company imported large quantities of woven cotton goods until 1685 when, owing to the opposition of the linen weavers the importation was prohibited, the prohibition not being removed until 1730. The art of calico printing was introduced into France from Pondicherry, but for many years (in fact until almost the end of the 18th century), English printers were harassed by restrictive legislation and the development of the printing industry in England was very slow.

14. From the position which Indian dyed goods held in the world's markets at the period referred to, it is evident that the quality must have been at least superior to that of those produced by other peoples, but whilst in other countries the workers have progressed and they with the aid of science and increasing knowledge have improved their processes, methods and materials, the dyers in India have failed to keep pace with the times, and from all accounts the quality of their work has deteriorated. "A comparison of the rule of thumb methods that pervade the dyeing crafts of India with the exact systems pursued in Europe leaves no room for doubt that in every direction the native dyer is far behind his western rival. The ignorance that exists in India regarding mordants would alone place the eastern craftsman at a disadvantage which no hereditary skill, however admirable, could redeem. It is no matter for surprise, therefore, that departures from the ancient methods and conditions of the dyer's art have been found unavoidable in response to modern demands." (The Imperial Gazetteer of India—The Indian Empire, Vol. III, page 185.)

"Cotton is the common dress of the people, and, outside Bengal, brilliant colours are popular. Almost every race and caste has its favourite costume, colour or method of attire, while festive seasons and ceremonials are marked by the use of distinctive colours in dress, and since the poor possess a limited number of garments, the desire for tinctorial changes can only be satisfied by the repeated bleaching and dyeing of the same fabric. To this circumstance may be possibly attributed the fact that the majority of Indian dyes are fugitive, no effort having been made to discover the mordants by which they might be fixed. To the desire for many changes in colour is doubtless also due the modern popularity of aniline and alizarine dyes. They are cheap, easy of application, fade readily, and can be applied time after time without injury to the cloth." (Extract from the Imperial Gazetteer of India—The Indian Empire, Vol. III, page 184.)

"While the record of most departments of Indian Commerce and Industry is one of continuous prosperity, the history of dyeing is one of decline. The influence of the modern mineral dyes (more especially aniline and alizarine) has been more destructive to the tinctorial and textile industries of India than is commonly supposed. These cheap colours have injured the artistic feelings of the people and demoralized many of the indigenous crafts. The delicacy and harmony of colour which formerly characterized Indian fabrics have given place to brilliant, if not gaudy and discordant, tints, while the reputation of these fabrics for durability of colour has at the same time been undermined. On the other hand, it has been maintained that the advances of modern tinctorial science have, in their ultimate issues, been in reality more constructive than destructive. This much at all events has to be accepted as a fact, that considerably more than half the colour results attained at the present day in India are due to aniline or alizarine. On the whole, the materials used by the dyers are not so much at fault as the change in the taste of the people, who have grown tired of pale, delicate colours, and have turned to the opposite extreme for something new. But when this craving for glaring colours has passed away, the Indian dyers are no more likely to revert to the old rejected vegetable dyes than the dyers of Europe have found it necessary to call for the production of the woad of their forefathers. The majority of the Indian vegetable dyes are fleeting, especially the yellows and greens, and all are relatively expensive and troublesome. One of the most pressing modern dangers lies in the fact that there are good and bad qualities of aniline and alizarine, and that their cheapness promotes the use of the inferior kinds." (Extract from the Imperial Gazetteer of India—the Indian Empire, Vol. III, page 181, chapter IV.)

Further, "one of the most imminent modern dangers lies in the fact that there are good and bad, cheap and dear, fast and fleeting qualities of the coal tar dyes." (The Commercial Products of India, Sir G. Watt, 1908, 345).

15. The introduction of artificial dyestuffs can hardly be held alone responsible for the deterioration in the quality of Indian dyeing, for the same dyestuffs have been available all the world over, and no one having any acquaintance with dyeing will deny that in Western countries the advancement in the art and practice was more rapid after the general adoption of these colours than before.

16. What has been lacking in the Madras Presidency so far as I can see is the capacity to take advantage of improvements. The earliest, cheapest anilines are still more extensively employed here, whereas in other countries they have long been superseded by improved colours of much superior quality. Not only so, the methods employed often bear no resemblance to those recommended by the makers (and proved to be the best in practice), simply because these methods entail a little more trouble and expense, and it will necessitate a radical change in the attitude of the people engaged in the industry and the methods under which it is carried on before any appreciable improvement can be looked for.

17. As already mentioned the bulk of the cotton dyed in the Presidency is dyed in the hank form, the yarn being chiefly obtained from the mills in Southern India and Bombay, whilst the finer counts are imported from England. It is hardly possible, I think, to obtain reliable statistics of the amount of yarn dyed, and the best idea of the value of the trade is perhaps obtained from a consideration of the quantities of dyestuffs imported as given in table A, although there is still some dyeing being carried out with indigo and other natural products.

Attention has been drawn to the fact that the preparation of the yarn which is generally given is insufficient to remove the natural impurities of the cotton and those which arise from the spinning processes, and would be improved by the substitution of an alkaline "boil" in place of a simple water "steep." The manipulation of the yarn during dyeing has also been already described and it remains to mention the colouring matters which are or were recently employed. The indigenous dyewares which are employed in the dyeing of cotton, wool and silk are treated of in the portion of the report dealing with cotton dyeing, whilst those which are used mainly upon wool and silk will be mentioned in the sections dealing with those fibres.

18. *Indigenous dyewares used upon cotton*—Turmeric (*Curcuma tinctoria Curc Longa*)—*Mamjal* (Tamil), *Pasupu* (Telugu), *Haldi* (Hindustani).—The dried and powdered rhizomes when boiled with water give an intensely yellow coloured solution, in which cotton, wool and silk are dyed "direct". That is, the fibres possess an affinity for the dyestuff and fix it to some extent without requiring the intervention of a mordant. The best and brightest shades are produced when the dyeing operation is carried on in a warm bath (not more than 140° F. = 60° C.) and in a faintly acid solution, such as is obtained by the addition of a little alum; under these conditions the shade obtained is also a little faster than when no addition is made to the dyebath. The dyeing operation in the case of self shades is concluded in about half an hour, but when a green is being produced upon cotton yarn previously dyed with indigo, it is stated that it requires about three days for the yarn to become evenly penetrated.

Although the yellow is bright, and effective when freshly dyed it is very fugitive, being removed from the fibre by washing and destroyed by exposure to light.

19. *Myrabolams*—(*Kadukkai*) is the fruit of *Terminalia chebula* and is best known as a source of tannin, being exported in considerable quantities on account of the large amount of tannic acid which it contains. The tannin is not only suitable for leather manufacture but after the removal of an accompanying yellowish brown colouring matter is largely used for fixing certain artificial dyes upon cotton.

With metallic salts compounds of various shades of colour are given, some of which are used in printing. Thus with iron salts a black precipitate (which forms the basis of ink) is obtained. This black is produced upon textile fibres by impregnating them with a decoction of ground myrabolams, drying and treating with iron liquor. In pale shades it has a grey, thin appearance and in full shades tends to be "rusty"; in consequence it was seldom used alone in European dyeing but was used as a bottom under logwood blacks. It has now been almost completely displaced by various direct and sulphide blacks, and especially by aniline black. It is still employed in the production of printed cloths at Ponneri, Saidapet, Karuppur, Masulipatam, etc. The dyers in these places also use the decoction of myrabolams for fixing the alum required as a mordant in the production of red shades with munjit, and the alum compound is also employed as a yellow dye, the shade being dull and in harmony with the rest of the dyes. Its fastness properties could not be ascertained with any degree of certainty, but from the appearance of certain cloths it is evident that it is not so fast as the other dyestuffs employed.

20. *Annato*—*Jabra virai* (Tam.).—The dyestuff is obtained from the outer portion of the seed of *Bixa orellana*. The dye solution is prepared by boiling the seed with water, and cotton is best dyed in the decoction (to which a little alkali has been added) at a temperature of not more than 60°C = 140°F. After about a quarter of an hour the cotton is lifted, squeezed and transferred to a bath of weak acid to develop the colour.

The dyeware is also used for silk, but the shades upon all fibres are very fugitive and it is now very little used.

21. *Catechu-cutch-gambier*.—Cutch is obtained from various species of *Acacia* and *Areca* by making a decoction of the softer parts of the wood and evaporating down, whilst gambier is obtained by extracting the leaves of *Uncaria gambier*.

In dyeing, the material is boiled in a solution of the dyeware to which about 10 per cent. of a copper salt (upon the weight of cutch) has been added. After allowing to stand for some hours the goods are treated for half an hour in a fresh hot bath containing 2 per cent. of bichromate of potash, then rinsed and dried. The shades so obtained are very fast and the dyeware until recently was extensively employed; the difficulty experienced, however, in obtaining the repetition of any given shade in a series of dyeings, owing to the variation in the quality of the dyeware from one and the same source has resulted in the general adoption of synthetic colours—notably those of the sulphide class—for the production of brown shades fast to washing and light.

22. *Safflower (Kusumba)*.—The flowers of *Carthamus Tinctorius* yield yellow and red colouring matters upon extracting with water. The yellow dyes (which are of no value) are dissolved out by treatment with cold water, and the residual flowers are then boiled, preferably with the addition of a little carbonate of soda. The more valuable red dye is thus extracted, and cotton is dyed by immersing in this solution, and working for sometime therein in the cold. The material is lifted and, after acidifying the bath with tartaric acid is returned and a bright pink shade is thus developed.

The shade is very delicate, but is not fast, being discharged very readily either by acids or alkalis, or by exposure to light.

23. *Sandal wood—Pterocarpus santalinus (sevappu sandanam)*—belongs to the class of insoluble red woods and was largely used at one time in wool dyeing. The shades obtained upon mordanted wool are very fast to washing but self shades are not fast to light, although in combination with other dyewares (logwood, fustic, indigo) the shades obtained appear to be satisfactory. Indian dyers do not use it, as they do not consider it to be permanent (Holder. Dyes and dyeing in the Madras Presidency, page 4, 1896), and its place has been taken by alizarine red and various artificial synthetic dyestuffs.

24. *Sappan wood—Caesalpinia Sappan—Varathangi (Tam.)—Bakkam, Patang (Hind.)*—is a red wood, the dyeing principle of which is known as brasilein. Cotton which has been mordanted with tannin and basic alum is dyed in bluish red shades in a slightly warm bath. Upon tin mordants a more orange shade is obtained, and upon a mixed mordant of alum and tin a scarlet is produced, by the addition of a little fustic (W. Indian Yellow Wood).

Dyed upon mordanted wool, it yields upon—

Chrome mordants	A bluish claret shade,
Alum	Bluish red,
Tin and alum	Scarlet.

The shades produced either upon wool or cotton are not fast either to light or washing.

25. *Semburam, Vembadam or Surul Pattai or puplai chukkai (Tam.)—Suratichekka (Tel.)*.—The root bark of the Semburam tree, *Ventilago Madraspatana*, yields a dyestuff which upon alum mordanted cotton gives a bluish red shade, on oil and chrome mordant a bordeaux red and with iron a grey to black shade. It was largely used at one time for modifying the shade of dyeings obtained with nuna root, but is not very fast either to washing or to light. The dyeing principle is ventilagin, a derivative of anthraquinone.

26. *Munjil* is a red dye contained in the roots and stem of *Rubia Munjista* and *Rub sikkimensis*. The main dyeing principle is a derivative of Purpuroxanthin (which like alizarine is a derivative of anthraquinone) but unlike alizarine, it does not yield really fast shades even upon a mordant such as is used for Turkey red (Crookes, Handbook of Dyeing and Calico Printing, 1874).

27. *Chay root—Indian Madder, Ohayaver or Siruver (Tam.)—Cheri Vello (Tel.)*—is the root of *Oldenlandia Umbellata*, and contains the glucosides of alizarine and methyl hystazarin, besides other derivatives of anthraquinone. The shades obtained are bluer than those with alizarine but are as fast in every way.

28. *Sooranje* (known as *al* in Bengal) is the root of *Morinda Citrifolia*, and contains morindin, the glucoside of morindon (Trioxymethylanthraquinone) which dyes upon an oil-alum mordant, like madder, giving fast red shades.

29. *Nuna (al in Bombay)—Mulugudhu (Tel.)—Mangkondhu (Mal.)*—is the root of morinda *Umbellata* and contains, besides other anthraquinone derivatives the glucosides of alizarine and morindon.

The last three products were supposed by Holder (Dyes and dyeing in the Madras Presidency) to be one and the same, but this is manifestly an error. In all, however, the dyeing principle is chiefly present in the root bark and they are applied by grinding the root and dyeing upon material mordanted with oil and alum. The shades thus obtained are very fast, but were modified usually in tone by the addition of *Ventilago Madraspatana*, the shade produced by which is not fast and gradually disappears, so that the dyeings so produced become brighter by washing.

30. *Alizarine*.—Of all shades upon cotton, those dyed with the ground roots of certain species of *Rubiaceae* have from the earliest times been noted for a degree of fastness to all influences which has never been equalled until the last decade. They have been dyed in the East from very early times, but the method of preparation of the dyeware and preliminary treatment of the yarn was unknown in Western Europe until introduced by the Turks, from which circumstance the dyeings became known in England as Turkey red, and on the continent as *Adrianopol Red*. In India, chay and nuna roots served as the source from which the dyeing principle was obtained but in Europe, Madder (*Rubia tinctoria*) was used, being much richer in alizarine than other species. Madder grown at Avignon contained four times the quantity of effective dyeing principle that was contained in a fair sample of Indian chay root. The trade in madder was a most important one, the exports from France in 1868 having a value of £1,000,000 sterling. The imports into England in the same year were valued at £1,000,000 and consisted of 15,294 tons of madder and 2,277 tons of garancine (a concentrated product). In 1868 the synthesis of alizarine was effected, independently by Perkin in England and Graebe and Liebermann in Germany, and the commercial preparation of the product, was so successful that in 1878 the imports into England of madder and garancine had fallen to 1,649 and 139 tons, respectively, and the exports from France had fallen in value to below £2,50,000. In 1870, the price of 10 per cent. alizarine paste was about 6 per lb., falling by 1881 to 1/6 per lb. In 1882 a 20 per cent. paste sold for 2/6 per lb. and 1886 for 8 d. The supply and price of alizarine are now controlled by a convention of manufacturers.

Fast red being such an important colour in the Indian market it was only to be expected that the artificial alizarine would be introduced here and it has, as was the case with madder in Europe, almost entirely displaced the indigenous products. I am informed by a dyer that the dyeing operation with alizarine paste cost him 50 per cent less than it did with nuna root, and that, as there were often difficulties with regard to the supply of the latter, the use of the imported dyeware was in every way preferable.

The over-sea trade in alizarine is confined to the ports of Madras and Tuticorin and as it is almost certain that the imports into Tuticorin are destined for the Madura district it is interesting to note the great increase which has taken place within the last few years in the imports through that port.

	1902-03.	1903-04.	1904-05.	1905-06.	1906-07.	1907-08.	1908-9.	1909-10.
	LB.	LB.	LB.	LB.	LB.	LB.	LB.	LB.
Madras	600,612	570,523	491,321	670,309	512,507	639,677	606,868	591,430
Tuticorin	362,632	545,216	449,837	451,290	411,926	691,249	661,164	740,205

The Madras imports have remained almost stationary, whilst those through Tuticorin have steadily increased and have more than doubled themselves in the period 1902—1909. Madura is certainly a centre of the dyeing industry, a much larger proportion of the people there being dependent upon one branch or other of the trade than in any other place visited by me. The quantity of yarn which is dyed in fast red shades there must be very great, and throughout the Presidency the fast red produced by the indigenous method of dyeing appears to be known as Madura red.

The process of dyeing Madura red is almost identical with that employed in the production of old Turkey red, the differences being in the nature of the oil used in mordanting, but especially in the source of the alum required to produce a fast lake with the alizarine. The fixation of the alum in the production of Turkey red occurs in a series of operations preliminary to dyeing with alizarine; but in Madura red dyeing the alum necessary to produce a fast lake is contained in the kasa leaves (*memecylon tinctorium*) employed. These leaves contain some 5 per cent. of alumina which is in such a form that it does not unite directly with the alizarine, but is absorbed together with the alizarine by the yarn, the combination of oil, alizarine and alum then taking place on boiling.

31. *Madura red dyeing*.—Yarn which is to be dyed Madura red is not boiled out before dyeing, but as received from the mills is subjected to the oiling treatment; to prevent entanglement it is 'leashed' in quarter bundles of 2½ lbs. each. The oils used are groundnut or gingelly, but chiefly the former on account of its lower price.

About 40 per cent. of oil is taken for a full shade, and is made into an emulsion with a quantity of "drawn off" liquor just sufficient to permit of the yarn being worked therein.* Thorough impregnation is ensured by "tramping", and the impregnated yarn is placed in stacks over night, the liquor which drains off being collected in small surface tanks into which liquid sewage (lant) from the houses also drains. Next morning the bunks are set out on poles in the sun to dry, and late in the afternoon are worked once more in drawn-off liquor to which a little sheep's dung, and lant from the surface collecting tank are added. The yarn again lies

* The "drawn-off" liquor is obtained in the washing of previous lots of yarn and contains the residues of oil, alkali, etc., which remained unfixed upon the yarn.

in stacks over night, is dried next morning, and is then worked in a fresh liquor, prepared by dissolving "Umari" or alkali in water.

Fifty per cent. of Umari upon the weight of yarn is required, but this quantity is not added all at once, but in the first steep only one-fourth of it is taken and the remainder in three equal parts on the subsequent days. This steeping liquor is brought up to its original volume each day by the addition of fresh water and the number of times the steeping and drying of the yarn is carried out is regulated by the quantity of oil taken and the depth of shade required.

The yarn is finally wrung out twice in fresh water, the liquor being collected for making up the oil baths for fresh lots of yarn and termed "drawn-off" liquor, and the hanks are then thoroughly well rinsed in running water. The yarn is bleached almost white during its passage through this series of operations and is now ready for dyeing.

In preparing the dye liquor, Alizarine paste is mixed with Kasa leaves *Memecylon tinctorium*) and water. For the first dyeing $1\frac{1}{2}$ lb. of 40 per cent. Alizarine paste are mixed with 7.8 or 9 "measures" of Kasa leaves, according to the depth of shade required, whilst for the second dyeing one-half these quantities are taken and for the third dyeing (in the case of very full shades) one-quarter of the quantities are used.

The mixture of Alizarine paste and Kasa leaf is made in a barrel of some 40 gallons capacity filled to about three-fourths with water; small quantities are taken in buckets, the oil mordanted yarn is worked therein and placed in a second barrel. When this is full, the impregnation in the same liquor is repeated, to ensure good penetration, and the yarn, and superfluous liquor, is transferred to built up cement tanks, 5 feet square by 4 feet deep, in which, covered with Kasa leaf, it is left to steep over night. Next morning it is transferred to rectangular copper dye vessels (42" long $\times$ 24" broad $\times$ 20" deep) set in brick work over a grate, by which they can be heated by direct fire.

Fifty lbs. of yarn are distributed on 12 sticks in each vessel together with the liquor in which it has been steeping. The liquor is slowly heated, the yarn being turned from time to time, and the operation is concluded when the dye liquor is "exhausted". The dyeing takes about 2 hours. The impregnation and dyeing with suitable quantities of the mixture of Alizarine paste and Kasa leaf is repeated in the same way a second and third time, as required, and the yarn is then thoroughly well rinsed, to remove adhering Kasa leaves and loose colour as completely as possible.

The process, it will be gathered, is complicated and tedious and although in the case of newer methods of dyeing Turkey red in Europe the results have not been equal to those obtained by the old red process, it is only to be expected that attempts will be made to shorten the period required for dyeing Madura red, the saving in time and labour compensating probably for the slightly diminished degree of fastness to washing which may be expected.

32. *Indigo*.—Of the indigenous dye stuffs, indigo of course is the one which has maintained its position the best, owing to its general fastness properties and to the fact that until the last decade there was no other blue dyestuff which for all fibres possessed an equal degree of fastness and purity of shade. Where cheap dark blues were required, logwood upon alum or copper mordant was sometimes used as a bottom under indigo, but the shade lost much by exposure. For dyeing wool, a number of artificial dyestuffs which competed with indigo have been on the market for sometime past, with the result that the use of the natural dyestuff has been more and more restricted to the dyeing of specialities.

31 Upon cotton there was nothing which possessed the same degree of all round fastness, though some of the direct dyeing aniline colours were equal to it as regards fastness to light, but were by no means so fast of course to washing. Then came the discovery of the sulphur colours and in this class many individuals compete successfully, as they are fast to washing and many of them are very fast to light. Just recently a new colour of this class has been placed upon the market, and it is said to surpass indigo in every respect as regards its fastness to light, washing and bleaching. Of other blue dyestuffs the most important is the Indanthrene blue of the Badische company which, owing to its brilliancy, and purity of shade and excellent fastness to all influences is rapidly making its way in the market and already is being dyed to no inconsiderable extent in the Madura district.

Indigo is without doubt the oldest of all known dyestuffs and judging by the methods in use among uncivilised peoples there can have been but little alteration in the processes of dyeing from the time of its discovery up to within the last few years. This is due to the nature of the dyestuff, which demands a special method of dyeing, and although there are differences in various districts in the preparation of the dye liquor this is merely due to the ease with which one or other of the assistants required may be obtained in the district in question.

Indigo itself is insoluble, and in this form cannot be permanently fixed upon the textile fibres; it is necessary to bring it into solution for the dyeing to be satisfactorily carried out, and it is in the substances employed in obtaining this solution that the differences above mentioned arise. Under the influence of reducing agents (*i.e.*, of substances or mixtures capable of absorbing oxygen) indigo is converted into a colourless substance known as indigo

* Umari or sarracutti is the product obtained by fusing the ashes of sea weeds or of plants growing by the sea on the South-East Coast of India. An analysis of a sample by the British Alizarine Company showed it to contain carbonate of soda 12.91 cent., sulphide of sodium 29.34 per cent.

white. Unlike the coloured parent substance, this white derivative is dissolved by aqueous solutions of alkalis, forming a greenish yellow solution. From the solution, textile fibres absorb the indigo white and this, upon exposure to the air is reoxidised to Indigo; microscopical examination of the dyed fibres shows that the blue colour is due to the deposition of minute particles of blue pigment on and in the fibre and it may be here stated that the aim of the dyer, to produce good dyeings, should be to ensure the particles being as finely divided (*i.e.*, as minute) as possible and that as large a quantity of the pigment should be in the interior of the fibre and as little as possible merely superficially deposited.

As regards the solution of the indigo, the reduction has been brought about in the past in almost all cases by the action of ferments and although in Europe other methods found employment, in India, it is almost certain that the fermentation vat has been chiefly employed. The indigo is prepared for dyeing by grinding to a fine powder with water (so that a stiff paste results which must be quite free from lumps) and, mixed with a larger quantity of water, it is then set away with the liquor from dhobies' earth (alkaline earth) together with Tagarai (Cassia tora) or other seeds, dates or any material rich in starchy matters or sugar which readily ferment. In six to seven days, the fermentation has developed sufficiently and by the addition of further quantities of dhobies' earth and lime, the vat is brought into condition and is ready for use*. The liquor is greenish yellow in colour with a blue scum of reoxidised indigo and after well mixing, and allowing to stand a short time so that any sediment may settle, the hanks of yarn, loosely tied together, are immersed in the liquor and left to steep, or sometimes they are gently worked by hand to ensure good penetration. Upon removal they are wrung, to free them from superfluous liquor and are exposed to the atmosphere until the shade changes from a dull green to blue, indicating that oxidation is complete. The dipping is repeated several times until the required depth of shade is obtained after which the yarn is soured off to neutralise the alkali and is then well rinsed. The number of dips to produce any given shade is dependent of course upon the strength of the indigo vat, and this determines also the fastness of the shade to rubbing. Of two dyeings identical in depth of shade but produced, one by dipping several times in a weak vat, the other by fewer dips in a stronger vat, it is certain that, the conditions in the vats having been otherwise the same, the dyeing produced by the larger number of dips will best withstand the effects of washing and wear, and is in every way superior to the other. It is however more expensive owing to the extra time and labour required, and as the prices paid for indigo dyeing are not very remunerative it is not surprising that in this presidency fairly strong vats are employed and the shade, even dark ones, obtained in few dips. Naturally then the colour rubs off badly, and I have seen materials in which the colour was so superficially dyed that, before reaching the consumer, the pigment had been removed from the exposed surfaces merely by the handling, leaving the cotton just faintly tinted blue.

In most districts in the presidency dark blue is not a shade which is much in demand and the bulk of the indigo dyeing I saw was for the production of shades approximating to black, red dyed yarn being topped with indigo until a full deep shade was obtained. The prices paid for dyeing such shades are very low, and it is difficult to understand how they can be remunerative.

The general fastness properties of indigo have preserved it until the last decade from any serious competition from synthetic products. It has been the artificially made indigo which has affected most largely the consumption of the natural plant indigo and it is a matter of common knowledge how largely this product has reduced the demand for the indigenous dyestuff.

Without doubt it is the length of time required to prepare the vat, and the variation in the quality of the dyeware which has told most heavily against the native indigo. The manufacturers of the synthetic product have met the conditions of the trade and demands of the dyers and have prepared standard brands of unvarying composition with which a vat may be prepared ready for dyeing in a few minutes. This is a matter of no small moment to the dyer and as the dyeware is supplied in packages of such a size that there is no waste, he finds it more economical in use than the indigenous product. As regards the comparative cost of dyeing, the statements made by the dyers naturally vary, for this will depend largely upon the district and the quality of the natural indigo used for comparison; generally, near the indigo-growing districts, the cost of dyeing with the synthetic product was stated to be about the same as with the natural, but in another district into which the indigo was imported from a distance the dyer calculated that it was cheaper by some 30 per cent. to use the artificial product.

The imports of synthetic indigo into the Presidency have not up to the present time been large, but they are rapidly growing and certain large users have already imported more in the first few months of the year than they did in the whole of 1910, and have quite dispensed with the use of the indigenous product.

33. *Mineral colours*.—On account of the fugitive character of the natural yellow colouring matters employed in India, the production of fast yellow, orange and green shades was impossible and the demand for bright shades of this class, which will withstand both washing and exposure to

* The practice with respect to the addition of alkali varies somewhat, for the fermentation is here and there allowed to develop before any addition is made. The practice is attended with risk, as in the absence of alkali the rate of fermentation may become very rapid and result in an excessive destruction of indigo from "over-reduction."

light has been met by fixing mineral pigments on and in the fibre. The yellow and orange shades are produced by means of chrome yellow and chrome orange, and green by topping the yellow with indigo.

The process consists in soaking the yarn in a solution of acetate or basic acetate of lead and then developing (before or after fixation of the lead with sulphate of soda) in a solution of chromate or bichromate of potash or soda. The yellow so obtained is converted into orange by treatment with hot alkali.

Large quantities of yarns coloured in this way are exported to the East from Europe, but the process requires a good deal of experience to carry out the dyeing economically and well, and recently, owing to the use of the poisonous lead and chromium salts, this class of dyeing has been scheduled among the "trades injurious to health."

34. "*Aniline*," artificial or synthetic dye-stuffs.—When dyers were dependent upon nature for the supply of materials suitable for increasing the value of textile products by imparting colour to them, India occupied a peculiarly fortunate position, in so far as many of the indigenous products were eminently suited for the purpose, and large quantities were exported to less favoured centres.

Until the middle of the 19th century the dyer was dependent for his colouring matters upon plant products, certain insects and a few mineral pigments. In 1856 the first discovery of an artificial organic (as distinct from a mineral) colouring matter—mauve—was made by Perkin, and in 1859 the process of manufacturing the far more useful magenta was discovered. The opposition which the introduction of these industrially-prepared dye-stuffs met with from the dyers was great, and only slowly overcome, but their brilliancy and comparatively simple method of application gradually ensured their adoption, and paved the way for the growth of the coal tar colour industry which has now assumed such large dimensions.

The artificial dye-stuffs originally made were, it is true, very brilliant, but were by no means fast and in the latter respect could not compare with many of the natural plant products. It was at this time that the generally expressed opinion that *all* artificial dye-stuffs are fugitive arose, and the opinion had some justification until 1868, which year saw the introduction of the first of the synthetic alizarine dyes. Since then the industry has been highly specialised and, assisted by the developments of chemical science and engineering, has succeeded in producing a variety of substances exceedingly well adapted to the colouring of all classes of products.

For the sake of simplicity the terms "natural" and "artificial" dye-stuffs are generally retained, but as a matter of fact, the dyeing principles of plants, and the artificial dye-stuffs may all without exception be classed as derivatives of the simplest aromatic hydrocarbon, coal tar benzene.

The number of natural dyewares, the composition of which has not been elucidated is rapidly diminishing and the dyeing principles of many of them have been prepared synthetically in a state of purity. Alizarine and indigo are two of the best known, but most of the others, not possessing the same valuable properties as regards fastness, would appear to possess no prospect of commercial success against the competition of other artificial dyewares and are not manufactured industrially.

35. According to their composition and methods of application dye-stuffs are divided into classes. Two main divisions are recognised (1) those which dye the fibres direct, without the intervention of a mordant, *i.e.*, substantive dyes, (2) those which require mordants (substances of acid or basic character which enter into combination with the dye-stuff) to ensure proper fixation on the fibre. The members of class (1) are highly coloured compounds which are taken up by the fibre without any change in the colour, but in class (2) we have also to deal with substances which give various shades, according to the nature of the mordant employed.

Turmeric, annatto, safflower, sanders wood and kapila are examples of natural substantive dyes, and chay and nuna roots, butea frondosa flowers, sappan wood, lac, cochineal, etc., of those which are most effectively applied with the assistance of mordants.

Since the introduction of the artificial dye-stuffs, our knowledge of the production of colour in organic substances has grown to such a degree that the molecular arrangements upon which the existence of "colour" in any compound depends have been particularised, and from the molecular constitution it is possible to state with a high degree of accuracy what the dyeing properties of any compound may be.

The artificial dye-stuffs which have been made number many thousands and, although the bulk of them have never found application industrially, those which have been found suitable for one or more branches of dyeing and are manufactured in bulk still number many hundreds and with fresh discoveries the list of valuable colours is rapidly increasing.

36. According to their properties and methods of application, they may be divided into many groups, among which may be mentioned, for cotton dyeing:—

- (i) Direct cotton dye-stuffs.
- (ii) Sulphide dye-stuffs.
- (iii) Tannin dye-stuffs or basic colours.

- (iv) Dye-stuffs which are produced by development upon the fibre.
- (v) Vat dye-stuffs.

(i) *The Direct Cotton Colours* form a large class of dye-stuffs distinguished by the property of dyeing cotton without the aid of mordants, in shades which are fairly fast to washing. The fastness to washing is not sufficient to meet the highest demands in this respect, but the method of application is so simple and the general dyeing properties are so good that their introduction quite revolutionised the industry, and they are used in all branches of cotton dyeing. The dyeing process consists in working the material in a hot solution of the dye-stuff, to which common salt, or Glauber's salt and a little alkali are added, and when the desired shade has been obtained, rinsing off in cold water and drying. They may also be used for dyeing wool and silk for they are mostly of the same type as the acid dyes for wool, but differ from these in possessing a distinct affinity for vegetable fibres. They are stripped to some extent by washing, especially in alkaline liquids, but as abovementioned they even meet moderate demands in this respect. The fastness to light is very variable, some members of the class are very fugitive whilst others equal indigo and are finding application in Europe for dyeing curtains and upholstery; some of the yellow dyes in this class belong in fact to the fastest colours known.

(ii) *The sulphide dyes* are as a class, of comparatively recent origin, and the number of useful colours in this group is rapidly growing. They are employed for dyeing shades which are fast to washing and light, and many members possess extremely good fastness to the latter agency; recently a colour belonging to this class has been placed upon the market the claim being made for it that it is far superior to the earlier ones, being fast to both light and bleaching. The process of dyeing is comparatively simple, the goods being immersed and worked in a dye-bath prepared by dissolving the dye-stuff, together with sodium sulphide, in hot water. Care however is required in the dyeing, as also in the storing and control of the materials, for the dye-stuffs, are insoluble in water, the sodium sulphide by means of which they are brought into solution deteriorates in quality by continued exposure to moist air and the dye-bath must be maintained in the right condition for dyeing (*i.e.*, free from precipitated dye-stuff) if shades perfectly fast to rubbing are to be obtained. This class of dye-stuffs however is eminently suited to meet the general demands for dyeings at a moderately cheap rate, fast to light and washing, especially where brilliancy of shade is not required and they are being already used to some extent in the presidency.

(iii) *The Tannin dye-stuffs* are basic colours and have been extensively used for all classes of material. They dye silk and wool direct, but for cotton they possess very little affinity and it is necessary to mordant the cotton before dyeing, to ensure proper fixation.

Tannic acid is the most suitable mordant, but as this is readily removed from cotton by water, it is necessary to fix it as an insoluble compound before dyeing.

The fixation is best accomplished by means of salts of antimony (antimony tannate being colourless) and the materials to be dyed are therefore impregnated with the tannic acid solution and are worked in a bath of antimony potash, tartrate (tartaremetic) or other easily obtainable salt.

The dyeings produced upon this mordant are exceedingly brilliant in shade and have found extended application, but very few members of the class are fast to light. It is to this class that the first discovered "aniline" dyes belong and it is the brightness of the shades obtained (such brightness as cannot be obtained upon cotton with any other dye-stuffs) which causes the continued demand for them. Their want of fastness is well recognised, but some of the newer productions in this class are great improvements as regards their fastness to light.

Still where any but the lowest degree of fastness is required, no competent dyer would think of using one of these colours; from their brightness, however, they are just those which apparently suit the tastes of many people and in India they are dyed in quantity, often without any regard being paid to the method employed. It is not common knowledge that they should be dyed only on mordanted cotton and when, as is very often the case, untreated cotton is simply immersed in a solution of the dye, the complaint that "aniline colours are not fast" is readily understood.*

(iv) *Insoluble dyes, produced by development upon the fibre*, form a comparatively small class of cotton dye-stuffs. Some are similar in composition to the direct cotton dyes, differing from these in being soluble in water, and therefore special methods of application are required. Rich full shades are easily obtained with them, the shades possessing good fastness to washing and some are very fast to light.

* What is surprising is, that people should have been content to assume that a great and highly developed industry was incapable of replacing, or making attempts to replace products which were proved to be defective, by others more suited to the requirements of trade. Since the inception of the colour industry not a decade has passed without far-reaching discoveries in tinctorial science having been made and the reproach of want of fastness of the artificial as compared with the natural dyes long since removed.

The South Indian Dyer, however, whether from prejudice, indolence or ignorance has been content to ignore the later developments and has continued to use almost exclusively the cheapest, most easily applied dyewares, and the blame for the condition of things at present prevailing here should not be laid upon the dye-stuffs but upon the lack of education and the initiative which has rendered futile the attempts made to introduce later and better products.

Aniline black, which when properly dyed is the fastest black we have, may be included in this class, and is produced by oxidising aniline in contact with the fibre. Various methods may be employed, the blacks obtained differing from each other in minor details, but one and all are characterised by extreme fastness to light and washing. The so-called "one-bath-black" (using potassium bi-chromate as the oxidising agent) is being dyed to some extent here, the common fault of this black—want of fastness to rubbing—being outweighed by the fullness and fastness of the shade.

(v) *The vat colours*.—Recent discoveries in colour chemistry have made it possible to supply the long-felt want of a series of colours which would, upon cotton, give shades capable of satisfying the highest demands of fastness to light and washing. In 1901, the Badische Company placed a brilliant blue dye-stuff upon the market, dyed in a manner comparable to that used with indigo, and fast to washing, light and bleaching. The value of the dye-stuff was at once recognised and its appearance was quickly followed by that of other blues, yellows, violet and other dye-stuffs. Other colour works were not behindhand and every subsequent year has added to the list of new dyes in this class, so that the dyer now has the choice of a wide range of dye-stuffs which dye cotton "in the vat" and yield shades the fastness of which is only equalled upon cotton by that of Turkey Red. In a communication from the Chemical Department of the University of Jena (Farb. Zeitung, June 1911) R. L. Von Klemperer, who has exposed a number of shades continuously to light for six months, mentions that whilst indigo lost considerably in depth, Helindone Fast Scarlet and Indanthrene Blue (two of these new vat colours) remained absolutely unaffected.

The value of this class has been recently recognised by some of the dyers in the presidency, for the dyewares are eminently suited to meet the most exacting demands which are made here, and although the cost of dyeing is comparatively high, the dyers in Madura in many cases are dyeing them in quantity.

37. *Wool Dyeing*.—It appears that there is very little wool dyeing in the presidency except in the case of yarns for carpet manufacture, and as methods in use are more or less general, it will not be out of place to deal with them in connection with the carpet industry at Ellore. The conditions prevailing in that industry have been fully dealt with by the Hon'ble Mr. Alfred Chatterton, B.Sc., in the monograph on the carpet-weaving industry in Southern India, (H. T. Harris, Madras, 1908) and since then there has been but little change. The main bulk of the carpets are poor in quality and made against advances to two Muhammadans by exporting English firms; but recently two educated Indians have become interested in the manufacture and are devoting more attention to the production of high-grade carpets. The best carpets are produced at present exclusively with natural dyes, whilst the inferior ones are dyed with "tin" dye stuffs. The people engaged in making the carpets are Muhammadans and appear to be exceedingly poor and devoid of all education. They are improvident and are unreliable as regards the attendance upon their work. The lack of education makes it impossible almost for them to absorb any ideas which would conduce to their improvement and the same obstacle lies in the way of getting them to improve their methods. The Muhammadan merchants realise that the complete loss of their trade is only a matter of time and still they say they are unable to alter the trend, as the demand is only for carpets at low price, and were they to increase the cost of manufacture by introducing and getting the workers to use better class dyes, the profits would be so small as to make the manufacture unremunerative. Only with difficulty can they make the industry pay even by the use of the cheapest materials and the methods at present employed. The texture of carpets is therefore impoverished by decreasing the number of warp threads and knots per foot, and thick twine instead of thin cotton is used to give the necessary body. The dyes used upon the cheap carpets are unsuited for carpet manufacture according to modern standards; they are "tin" dye stuffs bought in the bazaar, and from the packages shown it was evident that they were of the cheapest variety. They are chiefly of the fugitive basic class of dye stuffs which are dyed upon wool merely by immersing the wool in a warm solution of the dye-stuff, but the shades produced are not fast either to water or to light; some cotton dye stuffs (that is, dye stuffs primarily intended for the dyeing of cotton) were also seen, and although some of these colours may be dyed upon wool, it is evident that the dyers have no knowledge of the proper method of application but just trusted to the one and only method which they know.

38. The position is therefore not encouraging, for the dyers never come into contact with anybody interested in the sale of better class dyes and the idea that "aniline" dyes are fugitive will be confirmed in the minds of anybody who deals in the carpets made from yarns dyed with these dyewares. In all other countries the dyeing of yarns for carpets is carried on with specially selected dye stuffs, such as are recommended by the colour firms for the purpose. There may be said to be two qualities, one of mordant dye stuffs suitable for the highest class of carpets, the other the direct acid dyeing colours distinguished by fastness to light. The first class is comparable with the best natural dyes available, but from their initial cost and the greater trouble required in dyeing, they become rather more expensive in use than the second class which are dyed direct by the use of a little acid in the bath. These direct acid dyes are available in all shades and although in themselves some are very bright, they can in admixture yield all varieties of tone. Were the Indian dyers employed in the production of cheap carpets

to learn the economical application of this class of colours the cost of dyeing would probably be no greater than it is at present and the superiority in the fastness of the carpets produced would be such as to leave no ground for complaint when the price of the carpet is taken into consideration. Were the best methods of dyeing the mordant dye stuffs understood and applied by the Indian dyer, I am confident that no complaint as to the want of fastness of the shades obtained need arise. I am given to understand that the demands now made upon carpets shipped from the Levant to America are such that they can only be met by the use of this class of dye stuffs.

39. There appears to be some difficulty now in obtaining an adequate supply of wool for weaving at Ellore, and complaint is made that it cannot be purchased in the raw condition but only in the form of yarn, roughly spun by the shepherds. There is no control therefore over the cleaning and quality of the wool used, whereas were the wool delivered in the fleece the users could select the finer portions for the best carpets and use the coarser wool for lower grade ones only. The regularity of the spinning could also be improved. The wool obtainable is very coarse and approximates more closely to "hair" than to the fibre produced by sheep in cooler climates. At the Anjuman-i-mufid-i-ahl-i-islam, Madras, wool obtained from the mills at Cawnpore, and of a finer quality than that at Ellore is used, but of course is much more expensive. The yarn obtained from the shepherds is of various shades, some being light in colour and approximating to white, whilst much is a mixture of this light coloured fibre with more or less black or coloured wool. The lighter evenly coloured wool is used for the light and bright shades whilst the coloured mixtures are only dyed in the duller shades. The colour of this dark wool cannot be destroyed, but all grades require a preliminary scouring to remove grease and dirt before dyeing. The scouring is accomplished by working the yarn in a warm to hot aqueous extract of dhobies' earth, but the quality of the earth employed at Ellore is not good; it is of a very dark shade and the solution obtained from it is so brown in colour that white wool scoured in it is of necessity tinted. It is obtainable however at practically the cost of carting and I suppose that the cost of the small quantity of soap and alkali which would efficiently replace it would be sufficient to tell against the improvement in the appearance of the scoured wool which might be expected to result from their use.

The dyewares employed in the production of "distinctive" shades upon carpet yarns are, lac, flowers of the modugu tree, turmeric, jack wood, sappan wood, myrabolams, cutch, and indigo, although for certain light non-descript shades other materials of no great colouring power are used.

40. *Lac*.—The dye stuff is prepared by washing the stick lac, formed by a species of insect upon the twigs of various trees, and evaporating the solution obtained. It is of a deep purplish colour and dyes mordanted wool and silk in very fast shades; upon alum it gives a bluish red, whilst when dyed upon a tin mordant it yields bright scarlets similar to those obtained with cochineal. The usual method of dyeing in India is to soak the ground lac in a small quantity of hot water or a hot solution of alum; when the lac is thoroughly disintegrated, it is transferred to the dye vessel, which is supplied with the necessary quantity of water, alum and tamarind; the wool is entered, and the contents of the vessel are raised to the boil and the temperature maintained until the colouring matter has been fixed upon the wool.

41. *Mooru-kambu*.—*Flowers of Butea Frondosa* (moduga, dhok or palas tree), and known as *tési*, *késá*—*kesuda*, *palas keppul*.—The flowers are collected in March and April. They contain a yellow colouring matter known as butein, and yield upon boiling, with water a yellow solution in which cotton is dyed direct in shades however which are not fast to washing. The dyeing principle is not present in the "free" state in the flowers and it is advantageous to boil these first in a dilute solution of alum, acid or alkali and thus bring the colouring matter into a condition better adapted for dyeing. The shade obtained with flowers so treated is more orange than that given with untreated ones, but upon mordanted wool the shade obtained is dependent upon the mordant employed; thus there is obtained upon a—

"Chrome mordant, a deep terra-cotta shade.

Alum	"	an orange
Tin	"	a pure yellow
Iron	"	a brown olive

These colours are somewhat fugitive to light, and the *butea frondosa* flowers cannot therefore be classed among the more valuable natural yellow colouring matters." (The colouring principle of the flowers of *butea frondosa*.—A. G. Perkin, Chem. Soc. Trans. 1904. 1459-1472).

42. *Jack fruit tree*.—*Autocarpus integrifolia*, *jak* (Hindustani), *pela* (Tamil), *panasa* (Telugu), *halasu* (Canarese).—When freshly cut the heart wood is yellow, but on exposure to air it gradually darkens, finally becoming of a mahogany colour. The rasped wood is used as a yellow dye in conjunction with alum, the dyeing principles being morin and cyanomacurin.

The shades obtained are similar to those obtained with the West Indian yellow wood, old fustic, and are, on a chrome mordant olive yellow, on aluminium mordant a dull yellow and a brighter yellow on a tin mordant. The shades are not very fast to light, being slowly changed into dull browns. [Compare (I). A. G. Perkin, Trans. Chem. Soc., 1895, 937; 1905, 715. and (II) Rupe. Chem. der Natur. Farbstoffe I, 1900, (89)].

43. *Myrabolams and cutch*.—The effective principles of myrabolams and cutch are not considered to be wool dyes, and their use must depend upon the presence of ingredients which modify the shades produced with other dyes; as a matter of fact wool impregnated with tannin loses much of its affinity for dye stuffs.

44. *Indigo*.—A question of supreme importance in carpet dyeing is the method by which this dye stuff is fixed upon the wool. By dyeing in the fermentation or other suitable vat, the shades produced possess the good degree of fastness associated with indigo. The purity of tone may leave something to be desired and on this account, as also because the process is tedious and somewhat costly, it is not at all uncommon for dyers to resort to a method which is easy of application, but cannot be too strongly condemned.

By treatment of powdered indigo with oil of vitriol, various sulphonic acid derivatives of indigo are produced which differ from indigo in being soluble in water. The products are placed upon the market under the names of pensee-lac, indigo extract, indigo carmine, etc., and are dyed according to the general methods of the artificial acid dyes for wool; whereas, however, indigo-dyed in the vat yields fast shades of no great brilliancy, these sulphonic acid derivatives yield brilliant tones which possess but a very low degree of fastness to light.

The method of preparation and the application of indigo extract is described in the monograph on carpet weaving in Southern India (Harris) and it is evident that indigo prepared in this way is largely used. It is a curious state of things that leaders in the carpet weaving industry should condemn as fugitive all the dye stuffs used for this purpose in the West, and still use one which, owing to its well-recognised fugitive character, is only employed there for lower class of work.*

45. *Artificial dyes for wool*.—The affinity of the animal fibres for dyestuffs is greater than that of the vegetable ones, and the number of dyes which have been or may be used in wool dyeing is very great. The nature of the fibre however debar the use of those classes of dyestuffs which require the use of strongly alkaline baths, and the sulphide dyes and a section of the vat dyes therefore find no place in wool dyeing. The classes mostly used are the basic, the direct acid dyes, the chrome and alizarine colours (mordant dyestuffs) and such of the vat colours as may be dyed by the usual methods for indigo.

The basic dyes dye readily upon wool from a neutral bath, but although the shades produced are in the majority of cases rather faster to light than those given by the same dyestuffs upon cotton, they are not sufficiently fast to permit of their use in any cases where fastness to light is essential. They are powerful colouring matters and being so easily applied they have, as already stated, appealed to the dyers here, who apparently trouble themselves little about the purpose for which the dyed goods are intended. It is these colours which are chiefly used for cheap carpet yarns in this presidency and it is not surprising that dyeings with such dyestuffs do not give satisfaction to purchasers. No words can too strongly condemn the attitude of mind which makes the retention of such dyes and methods of dyeing possible, when efficient substitutes costing little or no more are available.

46. *The acid colours for wool*.—This is a very large class of dyestuffs, the members of which are characterised by the property of dyeing wool from an acid bath, without the aid of mordants. The dyeing process is very simple, the wool being entered into an acidified solution of the dyestuff which is slowly raised to the boil, and kept at that temperature until the dyeing is completed. There are differences in the rates at which the various dyestuffs are taken up by the wool, and the degree of fastness to washing, light, etc., and on this account it is necessary to make careful selection of dyestuffs suitable to the purpose for which the dyed material is intended.

For hosiery, ladies' dress goods, rugs, blankets, etc., which have to withstand very different influences, suitable dyestuffs in this class are available and for use in carpets there is a large number which are characterised by very good fastness to light and suitability for the production of compound shades by admixture with each other.

47. *The acid mordant dyestuffs* is a class of colour dyed like the acid dyestuffs, the members of which however have the property in common of fixing certain metallic oxides and thus yielding dyeings comparable with those of the mordant colours as regards fastness; in fact some of the very fastest colours we possess are now dyed in this way.

48. *The mordant dyestuffs* as a class yield exceptionally fast shades and have found extended application in the high class dyeing of wool. They are also used (but to a much smaller extent) upon cotton, chiefly in calico printing, for the necessary mordants are much more readily fixed upon cotton by printing, than by dyeing processes. They are best applied by first mordanting the wool and then dyeing, and though rather more expensive to dye than other colours, they are widely used in Europe for shades in which excellent fastness is required.

* In connection with question of natural and synthetic indigo, it is interesting to draw attention to a confusion of terms, in order to avoid misconception. The statement was made to me by one dyer that a certain shade, produced with a so-called "synthetic" indigo was not fast, so I asked to see the product in question; it had a bright coppery lustre and fracture and would best have been described as a "prepared" indigo, certainly not "synthetic" in the accepted meaning of the term; in fact from the result of an investigation by a gentleman to whom I sent some of the product, it is extremely doubtful whether it contains any indigo at all.

Were suitable representatives of this class introduced into the dyeing of carpet yarns, and the dyers became expert in their use, there need be little fear of complaint arising with respect to want of fastness of the shades produced.

49. *Silk*.—True silk is the product of various caterpillars, being the filamentous excretion in which the caterpillar envelops itself preparatory to passing through the chrysalis stage. The silk used in the presidency appears to be obtained chiefly from Mysore and Kollegal, a small quantity being imported also from Bombay.

Rail-borne Imports of Raw Silk into the Presidency of Madras.

Year.	Weight.	Value.
	LB.	RS.
1906-1907	489,929	37,08,999
1907-1908	538,296	48,18,815
1908-1909	459,880	37,23,203
1909-1910	394,144	31,84,235

50. In the Monograph on dyes and dyeing in the Madras Presidency (Holder, 1896) it is mentioned "that the raw silk seems to have been steeped in some kind of starch or size either to increase the weight or to preserve the fibre"; this is a misapprehension, the silk gelatine or silk gum (sericine), being the outer coloured portion of the silk fibre as it leaves the caterpillar, and envelops the true silk fibre (fibroine) which is colourless and which is obtained in a pure condition by dissolving the silk-gum in weak alkaline liquors. Investigation of the silk glands in the silk worm has shown that two liquids are contained therein, an inner colourless one and a surrounding one, the colour of which depends upon the kind of caterpillar and the species of plant upon which it has been feeding. Two glands are disposed, one on either side of the body, and they communicate with a capillary orifice—the spinneret—in the head of the silk worm; on spinning, a double thread is formed, due to the almost instantaneous coagulation of the flow from the two glands, the two portions of the thread adhering lightly to each other owing to the glutinous nature of the sericine. Sericine and fibroine differ materially in their properties, the former being soluble in hot water or dilute soap solutions, whereas the latter is insoluble. Raw silk is harsh and stiff and it is only by separating the fibres by dissolving away the silk-gum that the fibroine is obtained in the colourless, lustrous, supple form which we associate with silk.

This operation of "boiling off" as it is termed, is one of the most important through which the silk passes, for upon the efficiency and care with which it is carried out depend the lustre and strength of the finished product.

Silk is attacked even by boiling water and its strength diminished, and the effect of alkaline liquors is even more rapid; the object of the workman is therefore to remove the silk-gum as completely as possible and to expose the true silk as little as possible to the action of the liquid. In India the liquors used for boiling off are obtained by treating dhobies' earth with water, in which case carbonate of soda is the alkaline agent, or by digesting together dhobies' earth and lime, in which case caustic soda is produced.

Both these substances (and especially the latter) have an injurious action upon silk and their use, especially in hot solution, requires great care on the part of the workman if damage is to be avoided. Enquiries elicited the information that sometimes a portion of silk is spoiled in the treatment, and that it is usual for the workman to be handling the material constantly and to rinse it well immediately the bulk of the colour has been removed. The employment of a good neutral soap would minimise the danger, but a badly made soap containing free alkali would be as dangerous as the materials at present employed. In general, raw silk loses from 25 to 30 per cent. in weight on boiling off.

The operation of boiling off is necessary if lustrous bright shades are required, and in Europe the boiling off liquors are not thrown away as is here the case but are preserved, as they exercise a beneficial effect in dyeing in promoting the evenness with which the colour is taken up by the fibre. A certain quantity is added to the dyebath together with just sufficient acid to 'turn' the liquor, then the dyestuff solution is added, upon which the silk is entered and the dyeing carried out at a moderately raised temperature. In the largest Indian silk dyehouse I visited (i.e., in this presidency) all the dyeing was carried out in the cold. The boiling off was done hot, the liquors being heated in earthenware pots, but for dyeing, flat earthenware dishes were in use, the skeins of silk being suspended by means of twine from sticks and kept pressed down below the liquor until sufficient dyestuff had been absorbed to give the required colour. Only indigenous dyestuffs were in use here and I was informed that anything from 3 to 7 days was spent in getting any single shade.

51. Kapila, turmeric, annatto, lac and indigo were the dyes chiefly used, the dyer stating that the valuation of the natural products was a matter of experience but that difficulties often arose through the materials not being of the quality expected.*

* In the journal of Soc. Chem. Industry June 1900, A. G. Perkin gives the results of some analyses of kapila powder obtained from the North West Provinces. In some cases the admixture of foreign matter is looked upon as accidental, but in others the adulteration was undeniable, and only detectable by means which the Indian dyer could not well employ.

"Ground Red Brick" may sell as kapila, but is not of much value in the dyebath, any appears to be a common adulterant according to Perkin.

At other places a similar selection of dyes was used, together with cochineal and artificial dyes and it may be taken that where fast colours were wanted they were dyed with kapila, lac, cochineal and indigo. Green was obtained by means of kapila and indigo, dull purples by topping lac dyeings lightly with indigo, and blacks by dyeing a full indigo shade on a lac bottom.

The methods of dyeing turmeric, indigo, lac, etc., do not differ materially from those described under cotton and wool and cochineal is dyed in a manner identical almost with that for lac.

Kapila or *kamela* is a red powder found on the seed capsules of *Rottleria tinctoria* (*Malotus philippinensis*). The dyeing principle has been isolated and termed Rottlerin. When the powder is treated with a weak solution of an alkaline carbonate, a solution is obtained in which silk is dyed in fast shades of fiery orange, even without previous mordanting. (Rupe.) The general method of dyeing employed here is to mix the kapila powder with oil and alkali (liquor from dhobies' earth and water) and boil. A solution of alum is then added and the silk entered into the mixture and worked therein until it is evenly impregnated, when it is pressed below the surface and left until the required shade is obtained, the skeins being lifted and replaced from time to time to promote levelness of the shade. A yellowish orange is the result, which may be modified towards scarlet by the addition of sappan-wood to the dyebath.

52. Silk being an animal fibre approximates more nearly to wool than to cotton in its behaviour towards dyestuffs; i.e., it possesses a high degree of affinity for colouring matters, but whereas wool is best dyed at the boil silk takes up the dyestuffs best at a lower temperature, the most suitable degree of heat varying to some extent according to the colouring matter employed. It is very readily dyed by the tannin or basic colours and although in general the shades obtained are faster to light than those produced upon cotton they are in the majority of cases not very fast to washing although an improvement in this respect may be effected by after treating the dyeings with tannin, or tannin and antimony salt. The demands as regards the general standard of fastness of dyeings upon silk are not so severe as those which may be required upon cotton and wool, as from the nature of the fibre and its properties it is not generally expected that it will be subjected to the stress of every day wear like the other cheaper fibres, and therefore dyestuffs the use of which would be condemned upon cotton and wool are regularly used upon silk and the use is held to be justifiable. Still where the use to which the dyed material is put demands fast shades, the most suitable dyestuffs available should be chosen, and it is here where the Indian dyer fails. "Tin" dyestuffs are used in quantity in silk dyeing, and so far as I have seen they are mostly of this basic class, dyed simply by turning the silk in a warm solution of the dyestuff, and naturally the dyestuffs chosen are those which have nothing but their cheapness to recommend them. Attempts have been made to introduce better class colours, but the low priced ones hold the market. Some of these basic dyestuffs yield shades which withstand washing and light fairly well but these do not appear to be in demand here.

53. Silk is readily dyed also by the direct colours for cotton and the acid wool colours, but as these are two very large classes, it is only to be expected that wide differences will be noticeable in the behaviour of individual dyestuffs, and by careful selection a range of shades may be obtained suitable for any special purpose. Of the direct cotton colours a sub-section—that of dyestuffs which may be diazotized and developed on the fibre—should be very useful as by their use rich, full shades fast to washing and light may be obtained.

Where really fast shades are required (bearing in mind the limitations mentioned above as to the demands to be made upon dyed silk) the mordant colours would serve the purpose best. They are fixed, as is the case with lac, upon metallic oxides deposited in the silk fibre and though naturally the process of dyeing is more expensive than that with the direct or the tanning colours the shades are very much faster and it would be well if for borders of cloths for outdoor wear and such like materials these dyes were introduced in place of those which are at present employed.

Summary.

1. I have endeavoured to give in the preceding pages an idea of the nature of the dyewares and processes employed in dyeing in the presidency, but the conditions holding in the industry with respect to the supply of materials and the general methods of business are such that they are not very readily understood, and it is with diffidence that I pass any opinion upon matters which are not related to dyeing as such.

2. In Europe the dyeing industry may be said to be in the hands of men of some education and substance, who manage the works from a business point of view but who are not of necessity "expert dyers," although they are well versed in the principles of dyeing, manipulation of fibres and other necessary details. The real dyeing is carried out under the supervision of the foreman dyer, who is responsible for the work done; he is expert in the handling of materials and in the matching of shades and usually has plenty of initiative, but being responsible for the quick delivery of work, up to the market standard, he is chary of employing new methods and processes until compelled by the force of circumstances to do so. Once its value is proved, however, he adopts an idea and turns it to real practical use. The incentive to adopt new

methods usually has to come from the management, which, knowing the nature of the competition to be met, the prices ruling in the market and the prices at which work must be turned out to ensure a profit on the working, is in the best position to judge of the advisability of adopting new methods, plant or dyewares, and in some branches of the trade the changes in the requirements are so rapid that it requires a keen intelligence and thorough knowledge of materials and processes to keep pace with them.

3. Such conditions do not hold here and in the dyeing industry in Madras the absence of trained business men with technical knowledge is very noticeable. The demand made upon dyers is in the main, I think, for a product identical with what has been delivered in the past, but at a lower price if possible. The requirements as regards shade and fastness of colours remain practically stationary, and new and improved dyes find slow, little or no recognition, simply because they are new and different from what has hitherto been used.

4. The range of shades in use does not appear to be great, but to what extent this is due to customs and beliefs, to the tastes of the people or to the difficulty experienced in the past in producing a wide range by means of the indigenous dyewares, I am not in a position to say. Certain it is that I have not so far encountered in any country dyehouse a dyer who regularly produced a variety of tones by different combinations of the same dyestuffs. The art of rapid matching of any shade or tone with dyestuffs suitable to the market for which the material is intended is a prime necessity in a European dyer, and he spends some years in quite a subordinate position as assistant, gradually learning this part of his business from the head dyer to whom, as often as not, he has paid a substantial premium to initiate him into the trade.

5. The principles of colour matching are apparently understood to only a limited extent by the dyers in the Madras Presidency, who limit themselves, each one to the shades which have been in demand in his district for some time past and I have met with cases here where dyers have rejected dyestuffs of the very highest class as regards fastness and general properties, because the shades were not identical with those of a less suitable dyestuff which they were using when, by the admixture of very little of another colour, it would have been impossible for the purchaser to have differentiated one from the other except by the better behaviour of the new colour in wear.

6. The use of weights and measures also is absolutely necessary in modern dyeing if shades are to be rapidly and accurately matched, for the dyer must know almost exactly the quantities of the various dyewares he requires for a given weight of material, if the shade is to be obtained at the first attempt, but in the Presidency here the range of shades in common use being limited, weights and scales and accurate measures are apparently very little used.

7. Where an industry is carried on on a large scale, with efficient management and specialization in the various details of production, the advantages of apparently slight improvements are readily recognised, but we have in this presidency to deal with very different conditions. The industry is, in general, in the hands of craftsmen, skilled in the application of materials with which long use has made them familiar but so deficient in knowledge of what lies outside their immediate environment that they cannot appreciate the conditions holding in other places. Customs, beliefs, secretiveness or suspicion, and isolation assist in the retention of old ideas and ways and what is distinctly lacking is a knowledge of the principles upon which the operations carried out in dyeing are based. The technology of textile fibres, comprising the nature and methods of treatment of textile fibres, the nature and properties of the drugs and chemicals employed in the bleaching, dyeing and general improvement in the appearance of the fibres, the effects of and removal of impurities from water, and the properties of the large number of dyestuffs which the dyer has at command, is practically quite unknown to the ordinary dyer here. There is no literature which would serve to increase his knowledge and the only assistance he has apparently had has come from the travellers and salesmen of the artificial colour works who, by means of recipes and practical demonstrations, have placed him in a position to use their products and have given him information, in an empirical way, with regard to problems connected with dyeing.

8. The colour firms as a rule give instructions for the employment of their colours, which permit of the dyestuff being most economically and efficiently applied and these are usually closely followed, but the cases are numerous where variations have been attempted, or the instructions ignored and the powders dyed indiscriminately by the method affected by the dyer in question, with results which could not be considered satisfactory. I have met with dyestuffs which required no mordant, only the use of a little salt and alkali in the dyebath, being dyed with alum as though it were a mordant colour; on the other hand basic dyestuffs, which require for their fixation upon cotton a preliminary mordanting operation with tannic acid and a metallic salt, are regularly dyed without any other treatment than one with dhobies' earth, and it is no wonder that such dyeings, obtained by means diametrically opposed to those recommended for the colours in question, yield shades which are the reverse of fast.

9. A knowledge of chemistry, of the behaviour of fibres towards various reagents, and of the properties of different classes of dyestuffs, would assist the dyer to avoid the commoner faults, especially in dealing with the natural dyewares and products.

10. The valuation of the various dyewares and chemicals used is a most important matter, and in no place more than in India, where the demand for cheapness is carried to such lengths that in many cases it can only be met by supplying inferior materials and where the lack of knowledge of every day articles of commerce is such, that users are entirely in the hands of dealers.

11. The extent of the variation in the composition of indigenous dyewares is well known, and adulteration must, from all that can be gathered, be extensively practised and has contributed in the first place in no small degree to the displacement of the natural by the factory-made products.

12. As regards the trade in the synthetic dyestuffs, this is carried on in a manner which so far as I know is peculiar to India. The dye-houses being generally small and individually using no large quantity of dyestuff, the dyers do not come into direct contact with the colour importers but buy the colour in the bazaar, the dealer there obtaining it from a merchant who purchases in quantity from the importers. Usually the dyestuffs are imported in tins which bear registered labels, the property of the colour firms, and so long as the tins are intact and the covering labels unbroken the user has a guarantee that the contents have not been tampered with. Cases are not unknown however where, complaints having been made, investigation has shown that the contents of a tin had not been manufactured by the firm whose label was fixed thereto. The difficulty of deciding the nature and properties of any colour without a more or less exhaustive investigation is accentuated by the practice of merchants buying dyestuffs in bulk, transferring them to tins, and selling them under "fancy" names to dealers in the bazaar. No instructions being given, and neither the merchant, dealer nor dyer having any knowledge of the specific properties of the dyestuff in question, it is only to be expected that it will sometimes find application in directions for which it is unsuitable. In the majority of cases the dyer appears to buy not by the name, but only by the label and this may account, coupled with his ignorance in other directions, for the difficulty experienced in introducing new and improved dyestuffs; the dealer in the bazaar will naturally only stock such dyes as find a ready sale, the merchant who supplies him will only order these colours from the colour firms and it is only in the more progressive and larger dye-houses, which come into more intimate contact with the colour firms, that better class colours find recognition and application.

13. There is a tendency noticeable in some of the larger dyeing centres towards the erection of larger dye-houses by men with capital at disposal, but in many cases the courage might well be tempered with a little more discretion, for some of these gentlemen themselves have no knowledge of chemistry, practical dyeing, or the trade, and although it is in this direction that the best development of the industry may be accomplished, it is necessary for stability that those who direct such works should possess the necessary theoretical and practical knowledge to ensure that the work is economically and efficiently carried out. Should this trend continue, the conditions in the industry will be affected, as such places may be expected to work more economically in a steady market than the small dye-houses which are generally met with, and it would be advisable to prepare to meet the demand for education in matters appertaining to dyeing which the development is bound to create.

The problems which arise in the handling of bulk lots of material with the assistance of machinery differ somewhat from those which are met with in dealing with small lots by hand, but all such problems can be dealt with by a man who has had the necessary technical training and understands the theory of the process which is being carried out.

14. I would suggest, therefore, that means be provided in the Presidency for giving this technical training, but would point out that it cannot, or should not, be expected that in a school or technical institute, however well equipped, men can be trained so thoroughly that immediately they leave the institution they are able to take a controlling position in an industrial concern, for, besides a knowledge of materials and processes, such a position demands an experience of business methods and conditions which can only be obtained slowly and by direct contact.

At first, perhaps, the training would require to be of an elementary character adapted to the capacity of the students available, but in a few years it might be found possible and necessary to treat more fully the various subjects and train a class of men capable of dealing efficiently with the developments in the industry and evolving methods and appliances suited to the prevailing conditions.

15. I would propose that in any institute which may be provided for giving this training preference should be given (1) to those who by family associations are connected with the dyeing trade and would be able to take advantage of it afterwards and assist in the development of the industry, and especially to those of a better class who have a knowledge of English, and (2) to people who are in possession of capital and wish to start, or obtain an interest in, a dyeworks.

16. With regard to the location of an institute, the Presidency town offers certain advantages from its central position and the educational institutions to be found there, but these advantages are outweighed, I think, by a consideration of the claims of Madura where the dyeing industry has made rapid strides and where there is the probability of finding a number of students anxious to take advantage of the training offered, and where the institute would be in intimate touch with dyers who appear to be the most progressive in the Presidency.

17. From what I gathered during my tours a steady flow of students from the dyeing community in Madura might be expected, and individuals from Salem, Coimbatore and other places. The dyers at Salem, for instance, mentioned to me that they had considered the question of raising a fund to send one of their young men to be trained in England, but that if opportunity were given for suitable training in the presidency they would be glad to take advantage of it. Besides those connected directly with dyeing, I have met others who, seeking for means of utilizing capital, have already started, or were considering the question of starting, a dye-house, and although the supply of students from such sources is problematical the possibility should not be overlooked.

18. To decide upon the general educational attainments to be expected from the students is a matter of some difficulty, as personally I have had too little experience of the schools and the standard of knowledge imparted in them. From what I gather, the possession of a secondary school leaving certificate would be a good guarantee that a student would be able to take advantage of a course of training in the proposed institute, but in general I would say that, given a fair knowledge of English, it would be possible to arrange a course which would serve the purpose. On this account I mention the probability of the training being at first more or less elementary; but when parents realise that the better the preliminary education the fuller and more detailed can the specialized training be made, they will probably see that a full course in the secondary school is taken by their children. I am afraid it is too much to hope that there is any possibility of students from the dyeing community taking a course in science at one of the colleges in the presidency, with the idea of afterwards specializing in dyeing and devoting themselves to the industry, but the greater the knowledge of chemistry, physics and mechanical engineering possessed by people engaged in the trade the greater the possibility of development.

19. It would be advisable to arrange for instruction in theoretical and practical chemistry, technology of textile fibres, bleaching and dyeing, the testing of the properties of dyed shades and valuation of materials.

20. It would probably mean the attendance of a student during a period extending over two years and it would be sufficient perhaps in the first case to arrange for the entrance of ten students a year, until the demand for the training can be more accurately gauged than is at present possible.

21. To give effect to this idea would require the provision of a lecture room and dyeing and chemical laboratory with the necessary fittings, apparatus and store rooms, as also a space fitted up with plant suitable for demonstrating the methods employed in dealing with quantities of material larger than can be treated in an experimental laboratory. I have taken note of the proposals already formulated for the development of the Technical Institute at Madura and from the estimates and plans which I have had prepared I am of opinion that the initial cost of the provision would amount to about Rs. 40,000.

22. *Conclusion.*—It will be gathered from the foregoing that the development of the dyeing industry in this presidency is on the whole backward, and that, from the poverty and lack of education of the bulk of the people engaged in it, it is a matter of some difficulty to devise means whereby the conditions of things might be improved.

The people are content to meet immediate requirements only and making but very small demands in the way of profits are able to dye at a very cheap rate. The quality of the work, however, is not equal to that produced upon similar materials in other countries or in the mills in India, and the dyer here is not in a position generally to compete in any but his own local market.

The methods of business which prevail, especially in the handling and sale of dyewares, do not bring the dyer into touch with the developments of modern tinctorial practice, and his want of education prevents him from realising that products which were good enough in the past are no longer looked upon as suitable for many of the purposes for which they were formerly used and have been displaced by others with which better results can be obtained.

It is hardly possible to expect that under present conditions this state of things will improve, and the direction in which development can best be looked for is in an increase in the number of larger dye-houses controlled by men with capital at disposal and who possess technical and business knowledge.

Seeing that there are people interested or likely to be interested in dyeing who have capital at command, that business knowledge is rapidly acquired by intimate contact with an industry, but that technical knowledge can best be acquired after a preliminary training in a school or institute in which provision is made for the teaching of the necessary special subjects, I am of the opinion that Government could with advantage make provision to supply this technical instruction as being the most likely means of ensuring that the industry will develop upon lines suitable to Indian conditions.

F. MARSDEN,
Tinctorial Expert.

APPENDIX.

Cotton Printing in the Madras Presidency.

The processes employed in the decoration of cotton cloth by "printing" vary so little in different districts throughout the Presidency that a description of those employed by any single workman may be taken as being practically representative of all. In some cases the cloth is roughly bleached before being printed, and the treatment is advisable, as fibres which have been freed from the natural wax take up the dyestuffs more readily and evenly than when the waxes, etc., are still present. The treatment given consists in boiling well with lime, and then rinsing thoroughly in water, preferably in a stream in which "Valam Pasi" is growing. (Valam Pasi is a fresh-water plant, the statement being made to me that it "clarifies" the water in which it grows.)

2. The dry cloth is then soaked in a hot decoction of ground myrabolams and after lying therein for a short time is wrung out evenly and dried. The design is now painted or printed on by means of hand, or wooden blocks, with a solution of an iron salt thickened with jaggery, or "valam pisini," the gummy exudation from a species of thorn tree. The salt generally used is the protosulphate of iron (anna bedi), but in some cases the printer still prepares the marking liquor by steeping iron nails in an aqueous solution of jaggery, or other liquid liable to undergo acid fermentation. The interaction of the iron with the tannin matter in the cloth results in the production of "ink" and the design is thus clearly marked out.

3. The portions of the cloth which are to be dyed red are now treated with a solution of alum (thickened as in the case of the iron liquor) and the cloth set aside to "age" for a day. The tannin serves to fix the alum required for producing a fast red colour, and after rinsing to remove the superfluous tannin matter the cloth is brought into a boiling decoction of alizarine or ground munjit or chay root. The dyestuff is only fixed upon those parts of the cloth upon which alum has been previously deposited and the cloth is then rinsed and dried.

4. Before proceeding to dye those parts of the design which, it is desired, shall be of a blue colour it is necessary to treat the cloth in such a manner that in the indigo vat the liquor will only penetrate into the untreated parts, and to ensure this, all the rest of the cloth is coated with wax. The workman spreads the cloth on a low table and, dipping a metal style or pen (which has a ball of fibrous material about one inch from the point) into a pot of melted bees' wax, he rapidly spreads the wax over the parts of the cloth which require "reserving."

5. The whole cloth is then immersed in the indigo vat, drained and again immersed until the required depth of shade is obtained, after which it is rinsed, and the wax removed by working in boiling water. In some cases where different depths of shade or combinations of colour are required this waxing and dyeing may be repeated at various stages, but the process being costly and slow, it is only resorted to when a better price is obtainable for such elaborate cloths.

6. Yellow shades are obtained by means of alum and a decoction of myrabolams of pista, said to be the flower of the Kadukkai tree, but upon the source of this product I could obtain no definite information. The portions of the design to be dyed yellow have been kept unmordanted "reserved" during the previous operations and are now painted over with a moderately strong solution of the tannin matter, dried, and then worked in a bath of alum. When a green effect is desired, the tannin solution is painted upon the required parts of the cloth, previously coloured blue, and upon immersion in the alum solution the combination of the alum and tannin results in the production of a dull olive yellow, which superimposed on blue, gives a dull green.

7. After drying, the cloth is prepared for certain markets by soaking in starch water and then glazing heavily by friction.

N. Ref. on Cur. No. 6041, dated 4th September 1911.

Submitted to Government with reference to paragraph 2 of G.O. R. No. 227, Educational, dated 11th July 1911.

J. H. STONE,
Ag. Director of Public Instruction.

III

Memorandum No. 2193-3, Educational, dated 4th November 1911.

A copy of Dr. Marsden's report on the dyeing industry in the Madras Presidency is referred to the Hon'ble Mr. Chatterton for remarks which should be submitted as early as possible through the Director of Public Instruction. In forwarding Mr. Chatterton's remarks the Director of Public Instruction is requested to state his own views on the questions raised.

2. As at present advised, the Government consider that, without waiting until a new tinctorial laboratory is designed and constructed, it would probably be advisable that Dr. Marsden should start work immediately and arrange to give instruction in dyeing, by hiring a suitable building in Madura and erecting in it at once the smallest plant which is considered sufficient for the purpose.

L. DAVIDSON,
Ag. Secretary to Government.

To the Hon'ble Mr. Chatterton, with copy of Dr. Marsden's report.
Copy to the Director of Public Instruction.

IV

Memorandum No. 2193-4, Educational, dated 4th November 1911.

With reference to his letter, dated 22nd August 1911, submitting his report on the dyeing industry in the Madras Presidency, Dr. Marsden is requested to report the dyeing centres in this Presidency and elsewhere which he has personally visited and to state in particular whether he visited Berhampur where silk-dyeing is being carried on.

L. DAVIDSON,
Ag. Secretary to Government.

To Dr. Marsden (through the Director of Public Instruction).

V

Letter—from Dr. F. MARSDEN, Tinctorial Expert, Madras.

To—the Director of Public Instruction (through the Superintendent of Industrial Education).

Dated—the 11th November 1911.

In reply to Memorandum No. 2193-4, Educational, dated 4th November 1911, I have the honour to state that during the preparation of my report upon the dyeing industry in the Madras Presidency I visited dye-houses in

Madras Town.	Salem.	Kumbakonam.
Saidapet.	Coimbatore.	Aiyampet.
Tanjore.	Undiputhur.	Conjeeveram.
Trichinopoly.	Calicut.	Rajahmundry.
Madura.	Cannanore.	Ellore.
Tinnevely.	Mangalore.	Masulipatam.
Melapalayam.	Ponneri.	Bombay.
Munnirpallam.	Arani.	

When in Rajahmundry I made inquiries as to the extent of the dyeing carried on further north and being given to understand that the quantity of material dyed was not large, I did not extend my tour any further in that direction and thus failed to visit Berhampur in Ganjam.

In the article upon "silk" in Watt's "Economic Products of India," no specific mention is made of a well-developed silk industry in Ganjam, but Berhampur (Murshidabad), Bengal, is mentioned as one of the chief centres.

From the review of rail borne trade in the Madras Presidency I find that the weight of the raw silk imported into the Northern Circars is 20 maunds, the exports of raw silk by rail are about 100 maunds and the trade with other districts of the Presidency amounts to 114 maunds with a value of Rs. 76,634.

The methods of dyeing in general use are so similar in the different districts that it is very improbable that, had I visited Berhampur, I should have seen anything different to what I saw in other silk-dyeing centres.

No. 203-I, dated 11th November 1911.

Forwarded to the Director of Public Instruction, Madras, with reference to endorsement N. R.O.C. No. 417, dated 9th November 1911.

K. T. B. TRESSLER,
Ag. Superintendent of Industrial Education.

N. Ref. on Cur. No. 417/11, dated 17th November 1911.
Submitted to Government.

A. G. BOURNE,
Director of Public Instruction.

VI

Memorandum No. 3152-1, Educational, dated 20th December 1911.

Mr. Chatterton states that his remarks on Dr. Marsden's report on the dyeing industry in the Madras Presidency were submitted through the Director of Public Instruction with his letter No. 203 I., dated 9th November 1911. The Director is requested to forward at an early date Mr. Chatterton's letter and submit at the same time his own views on the points raised.

(By Order.)

M. S. MASCARENHAS,
Under Secretary to Government.

VII

Letter—from the Hon'ble Mr. A. G. BOURNE, D.Sc., F.R.S., C.I.E., Director of Public Instruction.

To—the Secretary to Government, Educational Department.

Dated—Madras, the 8th January 1912.

No.—Ref. on Cur. 6041/11.

With reference to paragraph 1 of Government Memorandum No. 2193-3, Educational, dated 4th November 1911, and Memorandum No. 3152-1, Educational, dated 20th December 1911, I have the honour to submit herewith Mr. Chatterton's letter No. 203 I., dated 9th November 1911, and to state that I have nothing to add to his remarks contained therein with which I entirely agree.

2. Dr. Marsden is now at Madura and I consider that a sum of Rs. 5,000 should, as proposed in paragraph 7 of Mr. Chatterton's letter, be placed at the disposal of the former to provide the necessary laboratory equipment under the following main heads:—

	RS.
Apparatus	2,750
Chemicals and dyestuffs	750
Laboratory benches and wood work	1,050
Office furniture	450
	5,000

I understand from Mr. Chatterton that this estimate has been prepared by him in consultation with Dr. Marsden.

3. The amount may be met from the lump allotment of Rs. 30,000 provided for the Technical Institute, Madura, in the current year's budget.

ENCLOSURE.

Letter—from A. CHATTERTON, Esq., Superintendent of Industrial Education (on deputation).

To—the Secretary to Government, Educational Department (through the Director of Public Instruction).

Dated—Madras, the 9th November 1911.

No.—203 I.

In reference to Memorandum No. 2193-3, Educational, dated 4th November 1911, I have the honour to offer the following remarks upon the report submitted by Dr. Marsden on the dyeing industry in the Madras Presidency.

2. Dealing with a chemical industry the report is necessarily of a highly technical character, but in regard to the descriptive details I would only add that they confirm in every respect the information I have from time to time gathered regarding the dyeing industry. Dr. Marsden in his report has given a number of statistical tables showing the amount of dye-stuffs imported into the Presidency, which shows that the industry is one of considerable magnitude and involves an annual turn over of a large amount of money. It may perhaps be worth while to supplement this statistical information by the following table which shows the amount of dyed yarn imported into Madras during the five years ending 1909-10:—

Numbers.	1905-06.	1906-07.	1907-08.	1908-09.	1909-10.
1 to 20's	Lb. 82,293 Rs. 52,920	97,612 68,196	67,018 50,647	22,604 17,277	27,138 16,279
21 to 25's	Lb. 2,400 Rs. 1,143	840 422			
25 to 30's	Lb. 163,770 Rs. 1,32,093	238,120 2,01,708	198,570 1,92,926	210,521 1,88,499	171,720 1,39,647
31 to 40's	Lb. 5,709,232 Rs. 46,49,024	4,373,375 37,90,586	3,814,060 36,47,373	4,051,738 37,74,123	2,923,004 25,70,820
41 to 50's	Lb. 41,789 Rs. 32,512	109,850 87,102	107,272 99,646	123,895 1,09,034	19,420 20,010
Over 50's	Lb. 404,564 Rs. 5,64,719	522,465 8,10,822	698,738 12,49,841	640,494 10,36,628	854,752 5,94,851
Total of dyed yarns ..	Lb. 6,408,848 Rs. 54,32,411	5,342,262 49,58,836	4,886,558 52,40,333	5,049,252 51,25,571	3,596,334 33,41,607
Total of yarn, grey and coloured.	Lb. 10,819,273 Rs. 89,29,316	11,148,108 99,44,050	10,309,525 10,599,495	11,186,116 10,999,167	8,594,822 7,677,551

From these figures it will be seen that in most years rather more than half the yarn coming into the Presidency is already dyed and it suggests the possibility that if the dyeing industry were placed on a better footing more grey yarn and less-coloured yarn would be imported. It must be remembered, however, that the quantity of imported grey yarn dyed in India is comparatively small and that the Indian business is mainly concerned with the dyeing of yarn manufactured in the country. This, at any rate, is the case in the Madras Presidency where the two great centres of dyeing are Madras and Madura. In the former the bulk of the work is done in the dye-houses attached to the Buckingham and Carnatic Mills, who only dye the yarn prepared in the mills, whilst in Madura the yarn is supplied by the mills of Tuticorin, Madura and Coimbatore. The position then of the dyeing industry is roughly that all the yarn spun in the country which is not used in the grey state is dyed in the country, that comparatively little imported grey yarn is dyed in India and that any considerable extension of the dyeing industry will be due to a corresponding expansion of country spinning. In regard to the south of India, and especially those districts in the neighbourhood of Madura, it is important to remember that the cultivation of Cambodia cotton which is spreading so rapidly is likely to lead to a very material increase in the number of spinning mills. At the present time a very large mill is under construction in Madura and others, I believe, are contemplated. This mill has, I understand, been put up mainly with a view to supply the local demand for yarn which in its turn is entirely due to the growth of the Madura dyeing industry. In this connection I would refer to the extremely valuable work done by Mr. L. K. Tulsiram who was the pioneer of the modern methods of dyeing in Madura.

3. Dr. Marsden's report reveals a state of things in the dyeing trade similar to that which exists in almost every indigenous industry. Foreign competition has been met by the uneducated artisans by the simple process of lowering their prices and turning out cheap inferior work. Naturally they readily took advantage of the introduction of aniline dyes as a means whereby, without much regard to the quality of their work, they could reduce the first cost. As Dr. Marsden clearly shows, the result has been that Indian dyed fabrics have altogether lost their reputation and the result is erroneously attributed to the displacement of vegetable dye-stuffs by those manufactured in the chemical laboratory, whereas the real truth is that the empirical methods of the Indian dyer who used vegetable dye-stuffs yielded better results than could be obtained by dyers elsewhere. Yet, since the industry has been put upon

a scientific basis through the work of numerous chemists, the Indian dyer has lost ground and is quite unable to do good work because of his inability to keep abreast of recent inventions and discoveries in connection with the dyeing trade.

4. Dr. Marsden's account of the industry is however far from revealing a hopeless condition of things. We must, I think, accept the fact that the vegetable dye-stuffs have become a relic of the past and that there is no hope of their ever becoming of economic importance again. The industry in Madura is in a flourishing condition and in places Dr. Marsden occasionally came across a man who was working a little more intelligently than his fellow craftsmen. The Madura industry has done well owing to the initial impulse supplied by Mr. L. K. Tulsiram and to the fact the dyers have from time to time received assistance from the chemists of the colour manufacturers who supplied the dye wares. Obviously what is wanted is an expert permanently on the spot to investigate difficulties as they arise, to advise regarding new developments and to bring to the notice of the dyers such new discoveries and inventions as are likely to find local application. In two directions it is probable that an expert might accomplish much useful work. The cost of dyeing, even in Madura, is unnecessarily high through the waste of dye liquors which are discharged before all the colouring matter has been utilized. By improvements in the process of working considerable economies can undoubtedly be effected in this direction. Further, it is probable that the introduction of pure chemicals such as alum and soda ash will, in the long run, be found to cost less and to yield much better results than those now obtained with such variable and impure substances as dhobie's earth, sarracutti, kasa leaves, and lant or domestic sewage from the houses of the dyers.

5. There is no doubt that Dr. Marsden makes out an extremely good case for the necessity of supplying the dyeing trade with expert technical assistance and I am in entire agreement with his suggestion that Madura should be selected as the centre for such work. I have already submitted to Government proposals for the establishment of a tinctorial laboratory in Madura in connection with the development of the Madura Technical Institute and pending the passing of final orders on those proposals I quite concur with the suggestion that Dr. Marsden should start work immediately in a hired building in Madura, but I doubt very much if any practical result would come from the establishment of regular courses of instruction. The people in Madura think they know all about dyeing that it is worth their while to know, even if they do not know all that is worth knowing; and it is essential in the first instance that the dyeing expert should establish his reputation amongst the dyers as an expert. If he starts at the outset giving elementary instruction in dyeing, it will not produce any material effect upon the minds of the dyers and it would be better that Dr. Marsden should devote himself to studying in detail the methods of dyeing now pursued in Madura, in obtaining a thorough practical acquaintance with the local materials employed and in demonstrating on a practical scale such minor improvements in the methods of working which naturally suggest themselves to any expert who examines the methods now in vogue. His success in this direction will establish confidence and the dyers will then undoubtedly come to him to solve the not infrequent practical difficulties they encounter, especially in connection with the introduction of new dye-stuffs with which they are not familiar. In carrying on this work Dr. Marsden will undoubtedly have many visitors to his laboratory and it is possible that he may be able to attract a few young men to work there. By adopting this procedure, we may look for immediate practical results, possibly of considerable commercial value, and then if it is ultimately decided to establish a permanent tinctorial laboratory and to give regular courses of instruction in dyeing in Madura, there will be every probability of students wishing to join.

6. The alternative is that Dr. Marsden should devote himself to the instruction of 10 or 12 boys in what at the best can be only empirical methods and it will be years before any results will be visible, whilst it is doubtful if the right class of young men will be attracted to this school. I am entirely opposed to any attempt to develop technical education by the grant of scholarships or by the admission of students who pay no fees. If technical education is worth having, it is worth paying for and the dyers in Madura are in a very flourishing state and can well afford to pay for such instruction in tinctorial matters as the dyeing expert may be able to give them. As soon as Dr. Marsden is in a position to give regular instruction in matters relating to dyeing, whether it be on a scientific or on a purely empirical basis, I think a minimum fee of Rs. 5 a month should be charged for every student working in his laboratory.

7. If Government decide to depute Dr. Marsden to start work at once, a sum of about Rs. 5,000 will be required to provide the necessary equipment and the bulk of this expenditure will be on apparatus and plant which can be subsequently transferred to the Technical Institute, if tinctorial chemistry and practical dyeing is made a part of the curriculum.

Dr. Marsden's head-quarters and that he should, in the first instance, confine himself to detailed study of the existing methods of dyeing with a view to practical demonstration of minor improvements in the industrial processes now in vogue and the gradual establishment of such relations with the local dyers as will pave the way to regular instructional courses in the event of its being decided later on to establish a permanent tinctorial laboratory. For this purpose a sum of Rs. 5,000 will be placed at Dr. Marsden's disposal for expenditure in the manner recommended by the Director of Public Instruction. The rent of the premises which it will be necessary to hire should be met from this allotment and formal application should be submitted, where requisite, for the purchase of such apparatus, etc., as may be needed. A forecast of the probable expenditure during 1912-13 should also be prepared and Dr. Marsden should be instructed to submit brief quarterly reports of the work which he is carrying on in order that Government may be kept informed of the progress made and the developments likely to become practicable.

(True Extract.)

L. DAVIDSON,
Ag. Secretary to Government.

To the Director of Public Instruction.
" Accountant-General.
" Financial Department.
Editors' Table.

Order—No. 112, Educational, dated 9th February 1912.

Dr. Marsden's interesting report contains convincing evidence of the extent to which the dyeing industry of Southern India stands in need of expert technical assistance. As to the form which such assistance should take, the Government agree with the Director of Public Instruction and Mr. Chatterton that Madura should be

EDUCATIONAL DEPARTMENT.

NOTES CONNECTED WITH G.O. No 112, EDUCATIONAL,
DATED 9TH FEBRUARY 1912.

[SUBJECT.—*Report on the Dyeing Industry by Dr. F. Marsden.*]

From the Director of Public Instruction, dated 4th September 1911, No. 6041.

Please see G.O. No. 184, Educational, dated 29th March 1911, and the notes therewith. In that order the Government approved the proposals made by Mr. Chatterton as to the nature and scope of the preliminary investigation to be carried on by Dr. Marsden (the dyeing expert). According to the programme approved in that Government Order, Dr. Marsden was to make a survey of the dyeing industry in this Presidency, to visit the several dyeing centres and to submit a report embodying suggestions for the improvement of the industry.

2. With his letter read above, the Director of Public Instruction submits the report of Dr. Marsden. The report is full and a summary of Dr. Marsden's suggestions is given on pages 19 to 22 of current file. The report shows that the development of the dyeing industry in this Presidency is on the whole backward and that from the poverty and lack of education of the bulk of the people engaged in it, it is a matter of some difficulty to devise means whereby the conditions of things might be improved.

Dr. Marsden considers that it is hardly possible to expect any great improvement under present conditions and that the direction in which development can best be looked for is in an increase in the number of larger dyehouses controlled by men with capital at disposal and who possess technical and business knowledge. But as there are people interested or likely to be interested in dyeing who have capital at command, and as business knowledge is rapidly acquired by intimate contact with an industry, while technical knowledge can best be acquired after a preliminary training in a school or institute in which provision is made for the teaching of the necessary special subjects, he suggests that Government could, with advantage, make provision to supply this technical instruction as being the most likely means of ensuring that the industry will develop upon lines suitable to Indian conditions.

3. He accordingly proposes that means be provided in the Presidency for giving this technical training. At first the training would require to be of an elementary character adapted to the capacity of the students available, but in a few years it might, he observes, be found possible and necessary to treat more fully the various subjects and train a class of men capable of dealing efficiently with the developments in the industry and evolving methods and appliances suited to the prevailing conditions. He points out that in any institute which may be provided for giving this training preference should be given (1) to those who by family associations are connected with the dyeing trade and would be able to take advantage of it afterwards and assist in the development of the industry, and especially to those of a better class who have a knowledge of English, and (2) to people who are in possession of capital and wish to start, or obtain an interest in, a dyeworks.

4. With regard to the location of an institute, Dr. Marsden considers that although the Presidency town offers certain advantages from its central position and the educational institutions to be found there, yet these advantages are outweighed, by a consideration of the claims of Madura where the dyeing industry has made rapid strides and where there is the probability of finding a number of students anxious to take advantage of the training offered, and where the institute would be in intimate touch with dyers who appear to be the most progressive in the Presidency.

He advises that in this institute instruction should be provided in theoretical and practical chemistry, technology of textile fibres, bleaching and dyeing, the testing of the properties of dyed shades and valuation of materials. To give effect to this proposal he considers the provision of a lecture room and dyeing and chemical laboratory with the necessary fittings, apparatus and store rooms, as also a space fitted up with plant suitable for demonstrating the methods employed in dealing with quantities of material larger than can be treated in an experimental laboratory necessary. He estimates the initial cost of his proposals at about Rs. 40,000.

5. In his scheme for the reorganization of the Madura Technical Institute, the Hon'ble Mr Chatterton did not make any definite proposals for the establishment of a tinctorial laboratory and dyeing house at Madura as he preferred deferring the consideration of the question until receipt of Dr. Marsden's report. He has, however, estimated the cost of a dyehouse and plant at Rs. 42,000.

6. Before therefore taking further action on Dr. Marsden's report, it seems to be desirable to have Mr. Chatterton's opinion on the suggestions made by Dr. Marsden.

Vide paragraph 2 of Mr. Tressler's letter.

7. The question of employing Dr. Marsden on the preparation of food stuffs is dealt with in the linked file below.

K.R.—25-10-11.

Dr. Marsden's report contains a mass of useful information and indicates plainly enough the scope for the employment of a dyeing expert, but it is essentially of a preliminary nature and does not furnish all the particulars required at this stage, nor is the matter as well arranged as could be desired; for instance there is no summary bringing together the defects observed and the possible means of improvement, nor is the character of instruction contemplated set out in any detail, while no attempt has been made to expound the nature of the accommodation which should be provided for the dyehouse, tinctorial laboratory, etc., and the preliminary estimates and plans have not been sent up. Dr. Marsden, however, has evidently made a careful survey of the local industry and, I should say, only needs to have pointed out to him what is requisite in order to supply Government with specific proposals for consideration. He is now in Madras and I expect Honourable Member would, after studying these papers, like to have a talk with him. Meanwhile I would let him have a copy of Mr. Chatterton's report on the Madura Technical Institute and ask him—consulting Mr. Chatterton if he so desires, making use of the draftsmen in Mr. Tressler's office and taking assistance from Mr. Tressler in regard to such matters as the cost of buildings, scale of establishments, etc.—to submit his plans and estimates for the necessary lecture rooms, dyeing and chemical laboratories, fittings, apparatus and store rooms, proposals for the establishment and so forth. Apparently plans and estimates have been prepared. What we want now is definite proposals and a clear idea of initial and recurring cost. Details are particularly necessary in regard to the proposed supply of "plant suitable for demonstrating the methods employed in dealing with quantities of material larger than can be treated in an experimental laboratory," for this part of the scheme sails dangerously near to Lord Morley's forbidden demonstration factories. Specific recommendations again are required as to the conditions on which students are to be admitted in the first instance. Apparently Dr. Marsden contemplates that instruction for the *artisan* will precede the *technical* training of future captains of the dyeing industry. That his own appointment, now sanctioned for two years, will have to be made permanent is probable. I would not employ him on the investigation of the preparation of artificial food stuffs, until his scheme for instruction and experimental work with regard to dyeing has been worked out.

L. DAVIDSON—28-10-11.

It will be well first to have Mr. Chatterton's views on the matter. The idea of putting Dr. Marsden on food stuffs is absurd and must be negated at once. He was sent here for a distinct purpose and must be used for that purpose. I will see him and talk to him, but meanwhile we want Mr. Chatterton's views, which should be submitted *through the Director of Public Instruction* and the Director of Public Instruction should be requested to state his own views when submitting the papers. Dr. Bourne will probably have some opinion on the matter.

If we wait until the designs of a new laboratory are prepared and building erected we shall wait until Dr. Marsden's period of employment is over! What I should think we should do is to hire, if possible, a house in Madura and erect in it at once the smallest plant Dr. Marsden thinks will do for the purpose and get him his chemicals and let him try his hand at teaching some thing at once. We shall soon see if the thing is going to be popular. If it is, we can erect a school at leisure. But I can't help thinking that there should be no delay in starting an experimental school. Please make this suggestion in sending the papers to Mr. Chatterton.

Dr. Marsden has not told us what places he has personally visited. I think he should tell us this. Has he visited Berhampur for instance where silk is dyed? Let him supply this information.

I should think if he has any plant or is using the Presidency College laboratories, he could work with profit at many subjects connected with dyeing while waiting for his school. Anyway he must *not* divert his attention to foods.

Where does Dr. Marsden live? Will the Secretary kindly ask him by demi-official if he can come and see me next Monday at 12 A.M. at my house in the Adyar?

M. H[AMMICK]—2-11-11.

Three drafts are submitted for approval. One referring the report to the Hon'ble Mr. Chatterton for remarks; the second requesting Dr. Marsden to report the places of dyeing centres he has visited and the third negating the proposal to employ Dr. Marsden on the preparation of artificial food stuffs.

Vide Demi-official No. 2193-2, dated 3rd November 1911.

2. In his demi-official just received Dr. Marsden states that he will call upon the Hon'ble Sir Murray Hammick on Monday as desired.

T.K.—4-11-11.

Perhaps Honourable Member may want the file on Monday.

R. SUNDARAM AIYAR—4-11-11.

You had better send him the file to-day *after despatching the passed drafts*.

L. DAVIDSON—4-11-11.

This file was submitted to Honourable Member on Saturday night so that he might have it when interviewing Dr. Marsden to-day: but it has been returned. Apparently Honourable Member does not want it for the interview.

Of the three passed drafts put up, two have issued (the two Memoranda Nos. 2193-3 and 2193-4), and one of these two has been slightly modified by Honourable Member. The memorandum as now modified will issue to-day, to be substituted for the one already issued. The demi-official to Dr. Bourne as now modified by Honourable Member will also be submitted for signature to-day.

R. SUNDARAM AIYAR—6-11-11.

Right.

L. DAVIDSON—6-11-11.

Demi-official—from the Hon'ble Mr. L. DAVIDSON, I.C.S., Secretary to Government, Educational Department.

To—the Director of Public Instruction.

Dated—the 4th November 1911.

No.—2193-5.

I am directed to inform you that the Government do not approve the suggestion in paragraph 2 of Mr. Tressler's letter No. 203-1, dated 22nd August 1911, that Dr. Marsden should investigate the preparation of artificial food stuffs while his report on the dyeing industry is under consideration. They are of opinion that Dr. Marsden should devote his entire attention to the dyeing industry. While waiting for orders on his report, he might perhaps with profit work at the Presidency College laboratories at many subjects connected with dyeing.

Demi-official—from the Hon'ble Mr. A. G. BOURNE, D.Sc., F.R.S., Director of Public Instruction.

To—the Secretary to Government, Educational Department.

Dated—the 8th November 1911.

No.—71.

Your demi-official, dated 4th November, suggests that Dr. Marsden might go on with some work at the Presidency College. I presume this suggestion was made

“Only an *obiter dictum*, I think, not an instruction. Please show.” prior to the issue of Official Memorandum No. 2193-3 of the same date wherein Dr. Marsden is instructed to proceed to Madura.

L. DAVIDSON—9-11-11.

In any case I have now discussed the matter with Dr. Marsden and he thinks that he could employ his time with much greater profit at Madura.

Reference is solicited to the demi-official to Dr. Bourne and to Memorandum No. 2193-3, dated 4th November 1911.

R. SUNDARAM AIYAR—9-11-11.

Submitted to Honourable Member. The draft demi-official below will perhaps meet the requirements of the case, but Honourable Member may wish to vary the terms and make them more explicit as he has seen Dr. Marsden and discussed the matters in issue with him since the 4th instant.

Demi-official—from the Hon'ble Mr. L. DAVIDSON, I.C.S., Secretary to Government, Educational Department.

To—the Director of Public Instruction.

Dated—the 11th November 1911.

No.—2777-1.

Your demi-official No. 71, dated 8th instant. My demi-official and Memorandum No. 2193-3 of the 4th idem were issued simultaneously. The memorandum merely indicated the line which Government would *probably* take; it was not intended as a positive instruction. The demi-official suggested a possible method of employing Dr. Marsden's time pending expression of the matured views of Government, but if you are satisfied that in the interval he can be better occupied at Madura, there is no objection to his proceeding thither and preparing the way for instruction work.

The above demi-official is all right—only omit the underlined sentence. The subject of Dr. Marsden's work was discussed with him for some time and I think he understands what I wanted. But he would like Mr. Chatterton's views and we must wait for them.

M. H[AMMICK]—10-11-11.

From the Director of Public Instruction, R.O. No. 417, dated 17th November 1911.

Dr. Marsden submits a list of the dyeing centres he visited during the preparation of his report upon the dyeing industry. He states he did not visit Berhampur in Ganjam. Please see Honourable Member's remarks on page 3 *ante*.

T.K.—21-11-11.

R. SUNDARAM AIYAR—21-11-11.

Honourable Member for perusal.

L. DAVIDSON—22-11-11.

Years ago (30 years). I got silk cloths at Berhampur, dyed dark blue, which were then a speciality of the place and much admired for ladies' dresses. I have never followed the matter up and the industry may have died out. The papers should be printed up now.

M. H[AMMICK]—24-11-11.

Letter from the Director of Public Instruction No. 6041, dated 8th January 1912.

The Director of Public Instruction submits Mr. Chatterton's letter containing his remarks on Dr. Marsden's report on the dyeing industry. Mr. Chatterton states that there is a good case for the necessity of supplying the dyeing trade with expert technical assistance and agrees with Dr. Marsden in considering that Madura should be selected as the centre for such work. He thinks that what is wanted is an expert permanently on the spot to investigate difficulties as they arise, to advise regarding new developments and to bring to the notice of the dyers such new discoveries and inventions as are likely to find local application.

2. In his proposals for the reorganization of the Technical Institute, Madura, Mr. Chatterton said that nowhere in the Presidency was the indigenous dyeing industry worked on a highly organized factory system, that in Madura specially there was a large amount of capital invested in the industry and that though he thought that a tinctorial laboratory and dyeing house at Madura would prove useful in developing the industries of the town, he would prefer deferring the discussion of the question till Dr. Marsden's report had been received. He, however, proposed in that connection a dyehouse and plant at a cost of about Rs. 42,000 and a staff consisting of an assistant on Rs. 100, a clerk on Rs. 30 and two peons on Rs. 8 and Rs. 7, should a dyeing section be attached to the school. He also estimated the cost of materials at Rs. 4,260 per annum. He now states that he has already submitted proposals for the establishment of a tinctorial laboratory in Madura and that, pending orders on the above proposals, Dr. Marsden should start work at once in a hired building. It is submitted that, as stated above, he has made no definite proposals in regard to the dyeing section in his letter on the Madura Institute. The proposal that Dr. Marsden should start work immediately, which was what was suggested by Government, may be approved.

Memorandum No. 2193-3, dated 4th November 1911.

3. In regard to the work Dr. Marsden should do, Mr. Chatterton doubts whether any practical result would ensue from the establishment of regular courses of instruction. He thinks that it will be years before any results will be visible and is not sure that the right class of young men will be attracted to the school. He therefore suggests that Dr. Marsden should devote himself to studying in detail the methods of dyeing now pursued in Madura, obtaining a thorough practical acquaintance with the local materials employed and demonstrating on a practical scale such minor improvements in the methods of working as suggest themselves. Mr. Chatterton observes “his (Marsden's) success in this direction will establish confidence and the dyers will then undoubtedly come to him to solve the not infrequent practical difficulties they encounter, especially in connection with the introduction of new dye-stuffs with which they are not familiar. In carrying on this work, Dr. Marsden will undoubtedly have many visitors to his laboratory and it is possible that he may be able to attract a few young men to work there.” Mr. Chatterton considers that by adopting this procedure, immediate practical results may be looked for and then, if it is decided to establish a permanent tinctorial laboratory and to give regular courses of instruction in dyeing in Madura, there will be every probability of students wishing to join. This proposal which is also concurred in by the Director of Public Instruction may be approved.

4. To enable Dr. Marsden to start work at once, Mr. Chatterton suggests, and Dr. Bourne supports the suggestion, that a sum of Rs. 5,000 as detailed below should be immediately placed at Dr. Marsden's disposal to provide the necessary equipment:—

	RS.
Aparatus	2,750
Chemicals and dye stuffs	750
Laboratory benches and wood work	1,050
Office furniture	450
Total	5,000

This may be done: but the Director of Public Instruction should be required to submit, where necessary, formal applications for sanction to the expenditure referred to, specifying the articles required.

5. As for the source from which the amount can be provided, the Director of Public Instruction states that it can be met from the allotment of Rs. 30,000 for the Technical Institute in the current year's budget. This may be approved. Reference is solicited in this connection to the Honourable Member's remarks, dated 6th November 1911, on the file relating to the re-organization of the Madura Technical Institute approving of the funds required by Dr. Marsden being provided from this head.

6. Neither Mr. Chatterton nor the Director of Public Instruction has stated whether any additional establishment will be required for Dr. Marsden. Orders are issuing sanctioning a clerk on Rs. 25 per mensem and a peon on Rs. 8 per mensem for the dyeing expert with effect from the 1st February 1912. Perhaps this will do for the present.

7. *Financial* may see before the file goes to the Honourable Member.

R. SUNDARAM AIYAR—16-1-12.

Yes, please. It seems a makeshift arrangement, but I do not know that any thing better can be done, and doubtless it is well to move cautiously. Dr. Marsden ought to keep Government periodically informed of what he is doing and whether he is making any progress towards building up instructional classes and securing a clientèle of dyers willing to consult him on points of difficulty. We should also have some forecast of the funds he will require in 1912-13.

L. DAVIDSON—17-1-12.

To the Financial Department.

FINANCIAL DEPARTMENT.

As a result of the consideration of the detailed report submitted by Dr. Marsden, the Dyeing expert, on the condition of the dyeing industry in the Presidency, it is proposed—

Paragraph 5 of letter on page 27 of current file and Educational Secretary's note above.

(i) that, for the present, classes for instruction on the subject need not be opened,

(ii) that Dr. Marsden should devote himself to studying in detail the methods of dyeing now pursued in Madura, and to demonstrate to the public on a practical scale such minor improvements in the industry as may suggest to him, and

Ibid.

(iii) that for the purpose of carrying out the investigation referred to in item (ii), a building in Madura should be immediately hired, and that an allotment of about Rs. 5,000 should be made for providing the necessary equipment.

Paragraphs 5 and 7 on page 27 of current file and Educational Secretary's note above.

	RS.
Apparatus	2,750
Chemicals and dye-stuff	750
Laboratory benches and wood-work	1,050
Office furniture	450
Total	5,000

* Paragraph 4, page 5 *ante*.

Paragraph 3 of Director of Public Instruction's letter, page 23 of current file.

† Page 147 of Budget Estimate for 1912-13, 1st edition (revised).

on account of the Madura Technical Institute. The small cost during 1911-12 on account of the rent of the building may, it is submitted, be also met from that lump provision.

2. The Director of Public Instruction states that the sum of Rs. 5,000 for the equipment (required in 1911-12) can be met from the lump provision† of Rs. 30,000 in the current year's budget

[The Director of Public Instruction is to submit* separate application for sanction to the purchase of the articles.]

Educational Secretary's note above.

[* A provision of Rs. 30,000 has been made in the Budget Estimate for 1912-13 on account of the Dyeing expert and establishment.]

As regards 1912-13, Dr. Marsden is to be asked to send in a forecast of the funds he will require. It is not likely that any very large provision will be required, and submitted that, pending the receipt of a report on the point, no action* is called for.

3. The proposals may, it is submitted, be accepted in Financial.

C.P.K.—24-1-12.

S.D.S.—25-1-12.

C. REILLY—26-1-12.

H. A. STUART—27-1-12.

To the Educational Department u.o.

EDUCATIONAL DEPARTMENT.

Honourable Member.

L. DAVIDSON—30-1-12.

I agree to the proposals—please issue order, at once. Mr. Burns, Bombay School of Arts, told me that in Bombay the aniline dyeing people have a man who gives advice on dyeing to anybody who wants it and I think he said has a laboratory and is himself a good chemist. I don't know if Dr. Marsden knows about this man; but he might be asked demi-officially if he knows anything about him. Probably he might get some useful tips if he visited Bombay and made enquiries about the matter.

M. H[AMMICK]—2-2-12.

A draft order is submitted for approval.

2. In regard to the Honourable Member's remarks about the man in Bombay, it is submitted that Dr. Marsden was permitted to visit and he did visit Bombay, but no reference to this man is made in his report. He may, it is submitted, be asked demi-officially whether he saw this man in Bombay. A draft is submitted.

R. SUNDARAM AIYAR—5-2-12.

The office draft is a wholesale quotation—without acknowledgment—from Mr. Chatterton's report which it is proposed to print. It will not do at all. Verbatim quotations should always be in inverted commas and in a case like this the method of lengthy quotation is quite inappropriate.

I have written a fresh draft.

A 2 It may issue in manuscript and then I should like to see the whole matter in proof. Dr. Marsden's report ought to be intelligently paragraphed and then the whole correspondence might, with the Honourable Member's approval, be laid on the Editors' Table.

L. DAVIDSON—9-2-12.

Demi-official—from the Hon'ble Mr. L. DAVIDSON, I.C.S., Acting Secretary to Government, Educational Department.

To—Dr. F. MARSDEN, Tinctorial Expert, Madura.

Dated—the 9th February 1912.

No.—84-1.

Orders are issuing to-day approving the Director's recommendations in regard to the initial stage of your work at Madura and placing funds at your disposal. The Government understand that the aniline dyers in Bombay received regular advice from an expert tinctorial chemist who is provided with a good laboratory. If you have not already heard of this and made yourself acquainted with the

nature of this expert's operations, I am to suggest that you should get in touch with him, if necessary visiting Bombay for the purpose. It seems probable that he might be in a position to give you material assistance.

Submitted to the Secretary with reference to **A** above.

R.S.—7-3-12.

I think the publication of Dr. Marsden's report and the orders thereon, etc., would do good and see nothing objectionable. May the Government Order be placed on the Editors' Table?

L. DAVIDSON--8-3-12.

Yes. I agree. Put on Editors' Table.

M. H[AMMICK]—12-3-12.

[G.O. No. 112, Educational, dated 9th February 1912.]

Papers to be read in Proceedings:—

Again G.O., No. 1845, dated 29.2.11

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Again G.O., No. _____, dated _____

190

Current No. _____ From the S.P.2., No 6041, dated 4.9.1901.

"	"	"	"	"	417/11	17-11-11
"	"	"	"	"	203/0.	9-11-11
"	"	"	"	"	6041	8-1-12

Cuo 3152 from the Suppl. Ind. Edn. no 203 of 8/18-12-11 not to be read

Pina all papers
except remainder
Cuo 3152

33P

ORDER. No. 112, dated 9.2.1902.

ps.

Dr. Harnden's interesting report contains ~~convincing~~^{convincing} evidence of the extent to which the dyeing industry of Southern India stands in need of expert technical assistance as to the form which such assistance should take the Govt. agree with the D.P.T. & Mr. Chatterton that Madras should be ~~the~~ Dr. Harnden's headquarters and that he should in the first instance confine himself to detailed study of the ~~local~~^{existing} methods of dyeing with a view to practical demonstration.

Best in my first
7/1

8

$\frac{119}{9212}$

minor improvements in the industrial processes now in vogue and the gradual establishment of such relations with the local bodies as will pave the way to regular instruction courses in the event of its being decided later on to establish a permanent line.

- Local laboratory. For this purpose a sum of Rs. 5,000 will be placed at Dr. Hardra's disposal for expenditure in the manner recommended by the D.P.C.

The rest of the premises which it will be necessary to hire should be met from the allotment and formal application should be submitted, when requisite, for the purchase of ^{such} apparatus &c as may be needed. A forecast of the probable expenditure during 1912-13, should also be prepared.

and Dr. Hardra should be instructed to submit brief quarterly reports of the work which he is carrying on in order that Govt. may be kept informed of the progress made and the developments likely to become practicable.

Ld.
9.2.12

18/2/12

ORDINARY.

PREFERENCE.

URGENT (a).

EDUCATIONAL
LEGISLATIVE DEPARTMENT.

Current No., dated 190 ..

G.O., No. 112, dated 9-2-1902Number of MS. pages sent { Correspondence including order or orders
(b)
Notes.....Docket. Young IndustryPassports in the
report of Dr. Harsden regarding
the state ofNumber (c) of copies required when struck off (not including
copies for volumes and editors' table which are retained
of the Press).Further IndiaComplete
Correspondence
and orders.

Notes

FOR RECORD.*

Madras Records	...	...	...	30	15
Ooty Records	...	...	...	3	3
For filing with original	...	...	...	1	1

Total ... 34 15

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SECRETARIAT.

(a) If a paper is marked to be printed urgently, the Superintendent of the section concerned should sign the Press slip. The Superintendent should exercise a careful discretion in the matter.

(b) Each letter, memorandum, or order, or set of orders, in the file of correspondence should be headed in succession with the Roman numeral I, II, III, etc., the number being written in red ink or blue chalk above the item. The particular papers to be printed in the special issue-copies should be indicated by the Roman numeral (I, II, etc.) by which that item has been headed in the correspondence file. All matter, including marginal remarks or references, to be printed should be written in ink and matter which should not be printed should be encircled. Initials and signatures that are not quite legible should be re-written distinctly.

(b¹) For rules regarding printing of notes, see the rules in G.O., No. 1220, Public, dated 30th November 1900.

(c) The number of copies and the details of distribution should be filled in by the Superintendent or Referencer concerned.

(d) In the absence of special instructions to the Press to keep matter standing for a specified period, ordinary papers of 8 pages and under will be kept standing for one week, and larger papers for two weeks only. The type of notes and of all confidential papers is distributed immediately after striking.

(e) This slip, properly and completely filled in, should accompany every paper sent to Press; it will be returned by the Press when proofs are furnished; it should be sent to the Press when a call is made for revised proofs or when a corrected proof is sent for striking. When finally returned by Press it should be filed with the original order or letter.

INSTRUCTIONS FOR THE PRESS.

(a) If, in the opinion of the Superintendent of the Press, a paper has been marked urgent unnecessarily, he should send the Press slip to the Deputy Registrar with a remark to that effect.

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A

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Type may be released after usual interval.

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Supdt.

Supdt.

Supdt.

(b) Three copies of proof of all notes should be sent for approval, except when instructions are given to the contrary.

SPECIAL INSTRUCTIONS.

TO BE FILLED IN BY THE PRESS.

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