

IX.—*On the Oxidation of India Rubber.*

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ABOUT four years ago Dr. A. W. Hofmann communicated to the Chemical Society an interesting research, which treated of the changes that gutta-percha is found to undergo by free exposure to air under the influence of a hot climate, and the author brought forward conclusive evidence to show that the deterioration in quality observed in the coating of the Indian telegraph wires, was to be accounted for by the gradual oxidation of the natural gum.* From a similar point of view I have lately had an excellent opportunity of studying the nature of the changes produced in *caoutchouc* by the operation of like influences. The example to which I beg leave to call attention is one of a very instructive character, and indicates a condition which must be observed in the India-rubber manufacture whenever it is desired to ensure the permanence of an unvulcanized material.

An article is known in commerce under the name of "Patent Waterproof Felt," which is manufactured largely for the purposes of a cheap packing, and is used in the exportation of silk and other valuable fabrics, stationery goods, etc., which are liable to be damaged by water. This material is sold in sheets of great length, and usually about a yard wide; it appears to be made by cementing or matting together the fibres of cotton wool, through the intervention of India-rubber paste or solution, so that after the evaporation of the coal-naphtha, or other solvent, and passing through rollers, a continuous and water-repellent fabric is produced.

About six years ago, I purchased some of this so-called waterproof felt, and made some useful applications of it in the way of photography; some of the material had, however, been laid aside until a few weeks since, when, upon examination, it proved to possess no longer the close structure and waterproof qualities of the original article. It then occurred to me to examine once more the material in the same manner that I had tested it six years ago, viz., by extracting the India-rubber with benzol, and noting the character of the film left upon the evapo-

* Chem. Soc. Qu. J., xiii, 87.

ration of the solvent. The original fabric thus treated furnished a beautifully white cotton flock, and a solution which, being evaporated, left a highly elastic film of pure India-rubber; but these characters are no longer possessed by the fabric examined at this later period. By digesting with benzol the cotton fibres are left in a discoloured condition, and a solution is obtained, which, upon evaporation, yields a resin, or brownish yellow, brittle substance, closely resembling shellac. A considerable quantity of this altered India-rubber has been extracted by solvents, and its properties may be thus characterized :—

It is freely soluble in alcohol, especially if warmed, in chloroform, wood-spirit, and in benzol, as already stated. It is not appreciably soluble in oil of turpentine or bisulphide of carbon, and but sparingly so in ether. In alkaline solutions, both caustic and carbonated, it is freely soluble, and may be again precipitated on neutralising with acids. Like India-rubber itself, it becomes bleached upon immersion in aqueous ammonia. The resin fuses below the temperature of boiling water, and when more strongly heated in a retort, gives off an amber-coloured oil of agreeable aromatic odour, besides furnishing water, a proof of its containing oxygen. At ordinary temperatures it is extremely brittle, and highly electric, so much so that it cannot be powdered in an open mortar without considerable loss. A glass rod coated with the substance exhibits the phenomena of "resinous electricity" when rubbed with silk. The chief examination has been made upon the substance extracted from the fabric by warm alcohol, which leaves insoluble, besides the cotton, a very small proportion of unchanged India-rubber, easily separated by filtration, and the amount of the brittle resin extracted in this manner from a square foot of the fabric weighed, after complete evaporation of the solvent over a water-bath, 74 grains. A quantitative analysis of this substance has been made, and the numbers furnished by combustion with oxide of copper indicate the following percentages, which I have placed in juxtaposition with the figures reported by Dr. Hofmann, for one of his compounds :—

			India rubber.	Gutta percha.
			J. S.	A. W. H.
Carbon	..	..	64·00	62·79
Hydrogen	..	..	8·46	9·29
Oxygen	..	..	27·54	27·92

For the reasons adduced by Dr. Hofmann in the case of the altered gutta-percha examined by him, I abstain from constructing a formula, and merely regard this substance as an oxidation product formed directly from caoutchouc by the absorption of atmospheric oxygen, in much the same manner as resins are formed from essential oils and other hydrocarbons.
