

The Acme of Achievement in the Production of Auxiliary Media for the Textile Industry

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The field of activity represented by auxiliary products is the subject of much controversy nowadays. Opinions differ widely, both for and against. Yet the actual expansion which has taken place in the manufacture of such products—the rise of this branch industry from its modest beginnings to the commanding position it occupies to-day—testifies more eloquently than any amount of

theorizing to the existence of a real demand for good auxiliary products. To ascribe this rapid development to the effect of mere advertising would be most unfair to our textile industry, in the face of its manifold achievements in every one of its branches. Clear proof of the relative importance of aids to textile finishing is furnished by the fact that our largest national chemical enterprise, the

I. G. Farbenindustrie A. G. of Frankfurt, has taken steps just lately to devote special study to this branch of activity.

The divergence of opinions as to the value of the various textile auxiliary products may be explained by stating that clear knowledge is as yet lacking both as to the properties which a good auxiliary product should possess and as to the application of any simple method of testing it for the possession of such properties. We propose presently to try and describe an ideal auxiliary product. Next to this we will endeavour to show, by reference to the manufactures of the firm of H. Th. Böhme A. G. Chemnitz, how much progress has been made towards the attainment of that ideal.

When we refer to textile finishing we intend that term to comprise all the intermediate chemical processes which transform textile fibres from the raw state into the finished commercial product. These processes include washing, bleaching, dyeing and chemical finishing, as well as certain special processes such as carbonizing and mercerizing, which, as we know, are of considerable importance to-day. The wideness of the range covered by these manifold processes will at once make it clear that our ideal product will have to meet very exacting demands, not always in harmony, indeed occasionally in actual conflict with each other. None the less I propose to tabulate a few of the properties most generally called for, and in doing so I want to make a distinction between qualities which I will call indispensable and others which are of especial value.

The indispensable requisites are those which the product must possess so that it shall not itself be actively responsible for bad qualities in the finished article, as it would be for example if it caused the formation of precipitates, if it attacked the textile fibres etc.

Qualities which will yield definite advantages over and beyond the results customarily aimed at in the finishing process we must class as valuable, because it is these which constitute the real usefulness of any auxiliary product.

Perhaps we may therefore differentiate as follows:

a) *Indispensable Requisites:*

1. *The product must be as far as possible "neutral" i. e. colourless, free from odour, and nonpoisonous, and must not have the slightest corrosive action upon materials or machinery etc.*

2. *The product must be readily soluble in water.* Water is the most widely used medium, indeed the only one in which any work on a commercial scale is ever done. In order that the product shall retain its full efficiency when added to boiling liquor, it should have a boiling point well above the boiling point of water.

3. *The product must be capable of remaining unaffected not only by those agencies which cause hardness in water but also by the usual acids and alkalis, oxidising and reducing substances, as well as high temperatures.*

b) *Valuable Qualities.*

1. *The power of soaking the fibres and enhancing the penetrating and permeating powers of the liquor — these latter points being not absolutely synonymous with mere soaking power.*

2. *The power of dissolving dyestuffs and further of finely dispersing such dyes as are commonly met with in the form of coarse-grained highly molecular particles mixed with colloid substances, so that these dye particles are able to find their way into the inner substance of the fibre.*

3. *Solvent action upon fatty substances of all kinds, added to the power of emulsifying such impurities as are insoluble — in other words, cleansing power.*

4. *Protective and softening action upon the fibres.*

If we finally emphasize that the product must possess all these qualities even when present in very dilute form, so as to be inexpensive in use, we shall probably have enumerated fairly well all the requirements which need to be taken into account.

I should like to add that in my view it is a mistake to speak of "equalising" or "distributing" power, terms which defy any close definition or any practical test. I consider this power — such as it is — to be the sum total and the final outcome of the valuable qualities already referred to.

To summarize briefly, we may perhaps say that an ideal auxiliary product must be capable of remaining unaffected by any compound or by any external conditions with which it may be brought into contact in daily practice. It must possess a high degree of soaking and penetrating power, it must have a pronounced solvent action upon dyestuffs as well as great cleansing power and at the same time it must

protect the fibres, so that the natural softness and flexibility of the material are fully preserved.

If we now examine the auxiliary products which are actually available for the purposes of the textile industry at the present day, we shall quickly recognize that whilst we already have a large number of good and in some respects excellent special products to draw upon, we are still a very long way from the all-round ideal product, which may possibly be altogether unattainable.

For a long time, soap and Turkey red oil held the field unchallenged as the sole representatives of their species. Soap — discovered, according to Pliny, by the Gauls — was long used for none other than cosmetic purposes. Its use on a large scale since the close of the XVIIIth century has been directly due to the growth of cotton dyeing and bleaching. Turkey red oil is of more recent date. Sulphurated oil — viz. olive oil — was first used about the middle of the XIXth century, until the time when the derivate of castor oil, employed in the process to which that oil gave its name, rapidly took its place as a product of importance. If we examine the one and the other in the light of the requirements laid down for an ideal product, they will not carry us very far. Neither will stand the test for No. 2 of the indispensable requisites above set out. Neither of them is capable of withstanding the action of lime or magnesia; soap possesses no power of resistance to acids, and ordinary Turkey red oil very little. There cannot therefore be any thought of employing these two substances for universal requirements without reservation.

Even the notable progress achieved in such directions as the production of the first lime-resisting oil, or the discovery of the pronounced steeping qualities inherent in certain alkalis aromatic sulphoacids, did no more than meet certain special requirements, and failed to bring us any nearer to the wished-for ideal product.

It did seem that the ideal had been attained when Freiburger hit upon the idea of introducing to the textile industry certain selected heterocyclic bases, well-known to-day under the name of "Tetracarnit". This last combines the indispensable requisites almost without exception: it gives a clear solution in water and is almost unaffected by the outside agencies to which reference has been made. It possesses steeping and penetrating power, its action as a dyestuff solvent and disperser is

universally recognized, and it exerts a cleansing action upon the goods. In practice, this substance has earned a high degree of appreciation in the textile industry by reason of the exceptional manner in which it does combine so many desirable qualities. It has, however, been criticised on the ground that its steeping power is inferior to that possessed by steeping agents pure and simple. The manufacturers replied by producing Novocarnit, the steeping power of which has latterly been so greatly enhanced that it has nothing to fear from comparison with other substances; and also by introducing Oleocarnit, a special product for use in cotton dyeing, which has good steeping power and also acts as a dyeing oil. Both of these products possess in other respects the same essential characteristics as Tetracarnit.

But even Oleocarnit, which would appear to fulfil all the requirements which we have said that an ideal auxiliary for all-round use should possess, cannot in fairness be actually described as such. One circumstance which tells against it is its inadequate cleansing action. It is true that Tetracarnit is still used to-day in special cases as a washing medium, but it could not be used as a substitute for soap (for instance), if only for the reason that apart from its insufficient emulsifying power, it would have to be used at so high a concentration that its cost would be prohibitive and the pungent odour resulting would make the working conditions too unpleasant to be tolerable. We must now put aside the thought of our ideal all-round and turn our attention to the special branch consisting of grease solvents and washing media.

The chief solvents of grease used in the textile industry to-day are chlorinated hydrocarbons, amongst which ethylene trichloride ranks high by reason of its particularly intense solvent action upon grease. It, however, shares with all other chlorinated hydrocarbons the drawback of not being soluble in water. It requires first to have emulsifying power imparted to it by the addition of substances similar to soap or, popularly speaking, it has to be made soluble in water. Whilst these ethylene trichlorides work excellently in wool-washing, they cannot be used in cleansing processes which call for boiling liquor on account of the low boiling-point of the grease solvent. To meet this shortcoming, chemistry has supplied us with the higher chlorinated hydrocarbons and the hydrated phenols, which work efficiently at higher

temperatures. Endeavours are made to get over the diminished resisting power resulting from the addition of soap-like substances by substituting oils possessed of the desired resisting power. It may be mentioned that we are able to-day to obtain commercially certain washing and grease-dissolving compounds such as Lanaclarin which are free from grease and which are quite unaffected by lime or acids.

The dyeing oils constitute a separate branch in themselves. They embody, practically speaking, the last of the desirable features which we have tabulated — the power to protect and soften the fibres. Recent endeavour has been in the direction of enhancing their steeping action and their powers of resistance. Avirol KM Extra is an oil which in this respect goes a long way towards satisfying the most exacting demands of the practical worker. Its steeping power is practically equal to that of the best recognized steeping media pure and simple. Even where very hard water is used, there is no separation or precipitation of solid, sticky lime soap. Its resistance to acids is so great that the product can be used in acid wool-dyeing processes with the most satisfactory results. The summit of achievement in regard to magnesia-resisting powers in particular can be claimed on behalf of Avirol E Finish, which gives a clear solution in liquor containing bitter salts even at such high concentration as 1 to 1. The composite

products Floranit M and Eucarnit show a very creditable measure of achievement in regard to acid and alkali-resisting power; the former is acknowledged as a valuable addition to mercerizing liquors, and the latter as a helpful ingredient of carbonizing liquors. For the softening of artificial silk, which constitutes nowadays quite a problem in itself, olive oil derivatives are largely preferred to the castor oil products. In this special field also we have to-day such products as Brillant Avirol SM 100 which yield very good results.

On looking back, the reader will see that in discussing the actual situation as it is to-day we have got further and further away from the ideal product of universal applicability which all of us are still waiting for. We are still a long way from it, indeed this one and only universal article will probably remain for ever unattainable. The chemical industry, however, if we avail ourselves of its best achievements, amongst which the special products mentioned as examples must certainly be included, places at our disposal auxiliaries which when used for the special purposes to which they are adapted, yield highly satisfactory results. Its task for the future will be to concentrate upon making these special products still more perfect, so that their range of application, still rather limited to-day, may be extended as far as possible if not indefinitely, so that eventually the whole character of the subject may be simplified.