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SWEDISH WATER AND AIR POLLUTION RESEARCH INSTITUTE

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THE SCANDINAVIAN TEXTILE INDUSTRY SUPPORT FOR WATER POLLUTION RESEARCH.

By Leif Bruneau, Projectleader.

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By Leif Bruneau, IVL Stockholm, Project Leader.

A Scandinavian research project dealing with water pollution problems in the textile industry has been organized on the initiative of the NORDFORSK "Planning Group for Re-use of Water in Industry". The details of the various parts of the project are now beginning to be worked out in different institutions and industries in Denmark, Finland, Norway and Sweden, since the complicated financial problems have now been resolved. It has been calculated that the project, which is expected to continue over three years, will cost approximately 8,5 Million Sw.Krs (1976 valuation). The financial support comes from NORDFORSK, NJ (The Industry Foundation of Scandinavia), different national research foundations, and also from industry.

The project is led by a Project Committee with representatives from the textile industries in the four participating countries; one representative from the Scandinavian Institutes for Textile Research, one from the Environment Protection Authorities, one from NORDFORSK, and the Project Leader. NORDFORSK is responsible for bearing the costs of the Project Management, and for the final accounting.

The project can most readily be described by reference to a schematic model of a dye works (Fig 1.). Incoming arrows indicate raw material, energy, chemicals, and water. Outgoing arrows are products, "clean" water, water containing biologically "non"-degradable, inhibitory or toxic chemicals, and water containing biologically degradable substances. The numbers stand for the five different partial projects.

THE PART PROJECTS AND THEIR GOAL.

Part Project 1. Internal measures.

1 A. Process technical calculations and tests.

According to investigations carried out in the textile industry in Sweden during 1976, the consumption of water varies considerably, but is on the average 190 m^3/ton. This figure agrees with those provided by the Danish textile industry, while the specific consumption in Finland and Norway is approximately twice as high. The high water consumption is reminiscent of the times when the water, after treatment, mercerizing and dying, was simply led into the nearest water course. The water expense was totally neglected, and the energy loss involved in discharging warm water was no major factor in the total calculation. Nowadays, water for industrial consumption is expensive, and it costs increasingly more to treat waste water so that it can be discharged into the recipient.

Water consumption within the textile industry depends of course on the type and age of the machinery, but it may be possible to decrease the water consumption in many cases without risking the quality of the product. Experience from other industries indicates that considerable reduction in water consumption can be achieved, but that there is little interest in changing processes which already perform effectivly. Since it is desirable to keep the expenses for water treatment as low as possible, internal measures should be carried out first. The water streams are often separated and therefore under a certain control.

The theoretical treatment of the partial project "Industrial Internal Measures" is to be carried out at the Swedish Textile Research Institute (TEFO), but in the project group which was appointed for the project, there are representatives both from industry and the textile institutes of the other member countries.

1 B and 1 C. Full scale tests.

The full scale tests are projects, which different industries have suggested should be undertaken in order to put the theoretical measures into practice. Four projects of this kind have started, and all of them are concerned with reduction of water consumption through re-use of water within different sectors of the production.

Almedahls Factories in Kinna have one project which includes re-use of rinsing baths. Almedahls AB has another project which includes re-use of water during film printing. Borås Wäfveri has a project going on which has the aim of reducing water consumption by circulation of water in a rotatory printing operation.

Part project 1 C is concerned with a preliminary survey of the water consumption during different operations in the Finnish textile industries.

In both projects 1 B and 1 C, a national foundation is responsible for 50 % of the project expenses, and the industry is responsible for the other half through its own work.

Part Project 2. Reduction of Non-degradable and Toxic Chemicals of Textile Process Water.

The criterion for satisfactory operation of municipal biological sewage treatment plants is that the bio-chemical oxygen consumption of the waste water is reduced. A good

working plant has a reduction efficiency of approximately 90 %, which usually means that treated water has a biochemical oxygen demand (BOD_7) of 25 mg/l or lower, which shows that degradable organic substances have been removed.

Both in the Scandinavian countries as well as in the rest of the industrialized world, there is, however, an interest in organic substances, which are non-degradable. On the one hand, they may inhibit the biological processes, and on the other hand may be precipitated during chemical processing in the sewage treatment plant and thereby affect the use of the sludge. Alternatively, they may be discharged into the recipient unchanged.

In the preparation of textile products, it is known that a great number of process- and auxiliary chemicals are used; with the introduction of synthetic fibres, substances specially adapted to hydrophobic fibres were introduced. A list of chemicals used within the Swedish textile industry has been produced in connection with the investigations. It includes approximately 5.000 products, note that the dyes are shown in groups. Among these chemicals, several are more or less "non"-degradable in conventional sewage treatment plants, and others may be suspected of retarding or even having toxic effects on the microorganisms in the plants.

This list of chemicals has already had the effect that several textile industries in Sweden have or will change over to use of less controversial chemicals. This trend is likely to be accelerated as experience with alternative chemicals extends.

This is of course the most effective, and surely the least expensive way of solving the chemical problem, but unfortunately, substances with toxic effects will continue to be used in the future. The part project will examine the treatment of water containing such undesirable substances. One possibility is that some waste waters in limited quantities can be separated in the dye works, and be treated either alone or together with similar waste waters.

Such treatment may be restricted to a certain machine or to certain parts of the production. Here, of course, the possibility of selecting the waste water will have great importance in certain cases.

Treatment of the total waste water would also be possible, but in that case, the investment and the operating costs would be of an entirely different order from those calculated within this project.

The treated water (the most practical treatment is with activated carbon) can, optimally, be re-used in the production, alternatively, it can be discharged directly into a recipient or into a sewage treatment plant. The last alternative is the most likely, as the waters in question probably also contain biologically degradable substances even after treatment. These tests are being carried out mainly by IVL, in close cooperation with the Water Quality Institute (VKI) in Denmark.

Part Project 3. Re-use of Textile Waste Water.

The project concerns the so called "clean" waters, which today are discharged separately from Swedish textile industries. These industries have, with the support of the Water Protection Authorities, separated their systems so that approximately 50 % have obtained the degree of "clean" water, for which the specification has usually been the attainment of a BOD_7 lower than 25 mg/l.

These waters are treated in the factory so that they can be recirculated instead of discharged. Different methods of treating these waters will be tested on a laboratory scale. The intention is that these laboratory tests later will be followed up by full scale industrial experiments.

The part project is operated in Denmark by the VKI and the Textile Institute.

Part Project 4. Chemical and Biological Characterization of Textile Waste Water.

Within Scandinavia many chemical and biological methods are used to characterize waste waters. On the chemical side, BOD_7 and COD are the most common, and a BOD-curve over a 20-day period can often reveal much about a waste water. The most common biological methods rely on fish tests, where the surviving, LD_{50}, is determinated by using different kinds of fish.

The intention of this part project is to produce some simple but specific tests, which can be recommended for use primarily in Scandinavia. It would of course be tempting, within a project of this kind, to produce new methods, but this has been considered unduly ambitious. It cannot reasonably be included in a textile project.

The part project is being carried out at the Norwegen Institute for Water Research (NIVA), but requires of course close cooperation with the Water Research Institutes in the rest of Scandinavia.

Part Project 5. Treatment of Textile Waste Water.

This part project was started before the present Nordic project was even considered, and the experimental part is already finished. Different textile waste waters have been treated in a pilot plant for biological-chemical purification in order to ascertain optimal treatment conditions. The material is being prepared for publication.

The Norwegen Textile Institute (TI) is responsible for the investigation.

The part projects adequately cover the water problems of the textile industry, but cannot of course be concerned with every individual problem.

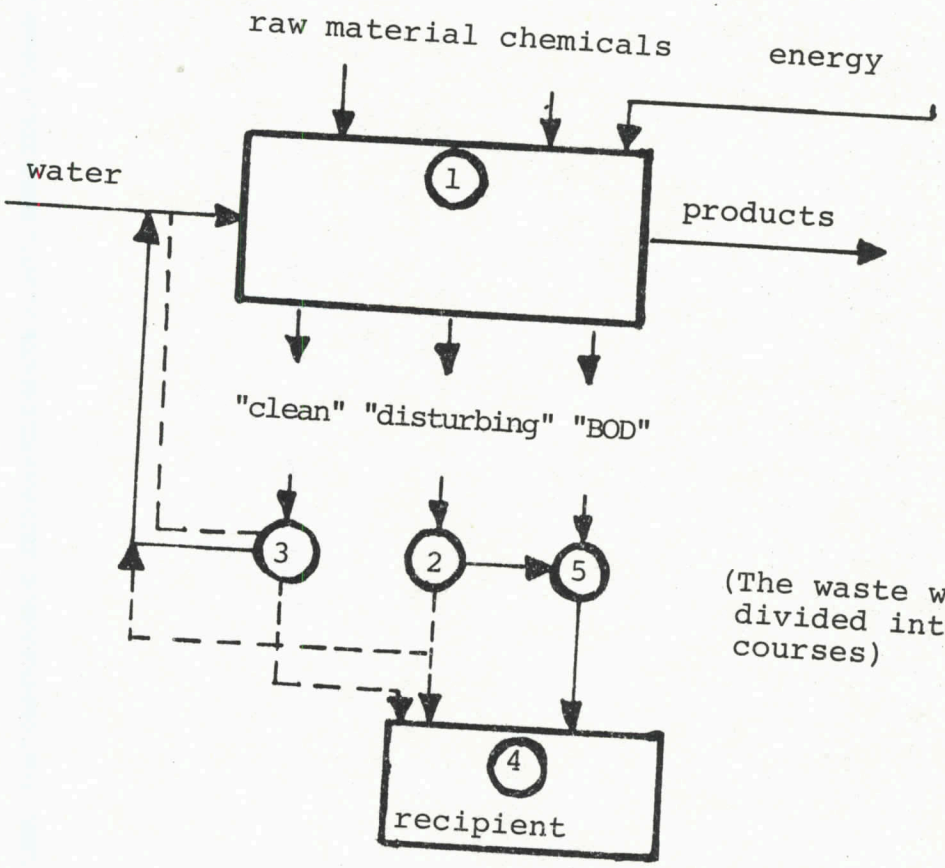
There is, however, reasonable optimism that the exchange programme concerning waste water problems in the textile industry is going to be considerably more effective than it has been hitherto in Scandinavia, and that we shall have the possibility of making the most of each others' experience.

We shall not, however, confine ourselves to Scandinavia, but also establish contacts initially with textile industries in the rest of Europe.

The idea is that reports shall be produced as soon as suitable parts of a project are finished. This is necessary among other things, to prevent unnecessary duplication of work. This cannot, however, be totally avoided since some overlapping of the projects is inevitable. Publications will be produced by the various institutes involved, but under the common designation "The Waste Water Problem of the Textile Industry".

Fig 1.

Schematic drawing of a dye work with its different types of waste waters.



The numbers in the circles piont out the part-projects.

SUMMARY

"The Waste Water Problem of the Textile Industry" is an inter-nordic research project which includes both internal and external environmental measures within the textile industry.

The purpose of the project is trying to find the technically and economically best solutions to the complicated waste water problem of the textile industry.

The project is financed by NORDFORSK, Nordisk Industrifond (The Foundation of Nordic Industries), the national technical scientific research councils together with the textile industry in Scandinavia.

The work is carried out in textile- and environmental research institutes in the member countries, and at some industrial enterprises.

The total project is divided into five part-projects which include:

1. internal measures
2. internal water treatment
3. re-use of water
4. effects on the environment
5. external water treatment

The project started during autumn 1976, and is expected to continue for three years at a total cost of approximately 8,5 Million Sw.Crs.