A modified nitric acid process for

Wood Pulping

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California's wood processing operations provide sufficient residuals to supply a number of pulping plants with adequate raw material. At present, a large percentage of this raw material must be destroyed in order to dispose of it. This results in waste of huge quantities of potential pulpwood. A major problem in utilizing the residuals in conventional pulping processes, as is done extensively in other states, has concerned the use of water. In pulping, effluents are produced which contain solids. These solids may be only a fraction of the total pulping chemical and wood going into the process but, based on the large tonnage produced, the material does introduce certain problems with respect to its disposal in a receiving water. Process designs are available which tend to minimize or even eliminate these problems, but the steps involved are generally expensive and non-productive.

Development of information on pulping processes which will be productive, economically feasible, and simultaneously compatible with the water requirements of the state has been an objective of certain work undertaken at the University of California Forest Products Laboratory. Through this work the number of processes that can be considered for potential use in the state should be increased. Expansion of the pulping industry would be of considerable benefit to the economy of the state, and should be encouraged through all possible avenues of approach.

A concept held as a guide since the start of this work has concerned the use of chemicals as pulping reagents recoverable in process streams and subsequently processed to products having value as fertilizers. In the processes contemplated for study, as in conventional processes, streams would be produced in which the chemicals would be at too low a concentration to permit economic recovery. However, since the pulping chemicals used in this work are also plant nutrients, it is anticipated that dilute streams could be utilized beneficially as irrigation water. Then, with careful selection of plant site, dilute effluents from such a process would actually have a beneficial use with no additional processing.

In one phase of the work being carried out, the nitric acid pulping process was selected for study. This method is not at present commercially competitive. With certain modifications, however, it appears that a process can be designed that will be competitive and also compatible with good water utilization.

Basically, the design involves treating wood chips with nitric acid at a suitable dilution and under atmospheric pressure, removing the excess acid with appropriate washing, and extracting the solubilized wood components from the nitric acid-treated chips with a solution of ammonium hydroxide. Under mild reaction conditions the chips produced are softened in the extraction step and may then be defibered mechanically. Under somewhat more severe reaction conditions the resulting chips are readily defibered with only mild agitation of slurries to give pulps.

The use of ammonium hydroxide rather than sodium hydroxide in the extraction step will permit processing of the spent acidic stream and spent basic stream to produce a nitrogen fertilizer. Under some of the conditions studied it has been possible to produce a product with a nitrogen content as high as 25% on the solids basis. It has been demonstrated in pot-culture tests that products have no untoward effects with respect to plant growth and that the nitrogen present is as effective as a plant nutrient as that present in ammonium nitrate.

Reactions have been carried out in which the amount of nitrogen introduced into the process in both the nitric acid and the raw material has been taken into account in determining the amount of nitrogen recovered in the products of the reaction. This material balance with respect to nitrogen, other than that contributed by the ammonium hydroxide, has been obtained by analysis of various types of nitrogen containing materials in the off-gases of the reaction, spent acidic extract, basic extracts, and pulp. Results have indicated that loss of nitrogen from the process by conversion to products which are presently considered to have no value may be as low as 10% when expressed as nitric acid and based on the pulp produced. This consumption may be varied over a wide range depending upon a number of process variables. Process economics are clearly very dependent upon the particular set of reaction conditions selected, the quality of the pulp produced, and the quality of the fertilizer produced. Studies are being continued in order to make a preliminary evaluation of each of these sets of factors.

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Use of colored derivatives of

ORGANIC ACIDS

The conversion of fatty acids into solid derivatives is useful for identifying organic acids which may be present in the free state or as esters in volatile flavor fractions. The separation of mixtures of colorless derivatives by column chromatography has been in use for some time, but small amounts of material are difficult to detect by this method.

These difficulties have been partly resolved by the development of new techniques for the preparation and separation of brightly colored derivatives of organic acids. Amounts as small as 0.3 milligram of these derivatives are readily visible on silicic acid columns where mixtures of benzene and Skellysolve B are used as the developing solvent. Even smaller amounts of the derivatives can be separated by paper partition chromatography.

Colorless esters have also been converted into colored compounds which function as second derivatives of the original fatty acids. These double derivatives of the fatty acids are readily visible and are separable on silicic acid-nitromethane chromatographic columns.—*R. E. Kepner, Dept. of Chemistry, Davis,* and *A. D. Webb, Dept. of Viticulture and Enology, Davis.*