sage of the wastes through the filter beds results in the partial oxidation of the wastes.

The National Council has conducted extensive experimentation with the application of the trickling filter process to a wide variety of effluents, ranging from spent liquor to paper machine overflows. While the results of this work show that the wastes tested were responsive to this form of treatment, there still are difficult technical problems to be solved. As the BOD loadings possible with filters are relatively low, high capital costs for the process are involved. These units also have a tendency to clog due to the fibrous nature of the wastes applied, as well as to the form of microbial growth on filter stone produced by papermill wastes. It is because of these limitations that application of this process to pulp and paper mill wastes has not been general.

To date, the activated sludge process, and modifications thereof, in which the wastes are contacted with biologically active sludge in tanks in the presence of oxygen have appeared to offer the best methods for satisfying the oxygen demand of pulp and paper effluents where a high degree of BOD reduction is required.

The national council research project at Louisiana State University first demonstrated that kraft mill effluents could be stabilized at greatly accelerated rates using this technique. Since this initial work on kraft wastes, activated sludge experiments have been conducted on practically all types of pulp and paper effluents, it has been found that substantial BOD removals are attainable with most wastes at detention periods of 4 hours or less. The rate of oxidation with these effluents is normally higher than with sanitary sewage because of the higher temperatures at which oxidation takes place and because of the improved aeration and sludge-effluent contacting methods employed.

With respect to aerated lagoons, the national council project at Johns Hopkins has been especially active in developing this technology. For locations where the limited requisite land area is available, accelerated aeration in reasonably short periods, that is, 5 to 10 days' retention, provides an effective means of oxidizing the waste.

BOD reduction is adjusted to meet dissolved-oxygen conditions in the receiving stream. Storage oxidation basins achieve in general from 30 to 80 percent BOD reduction, depending on storage time, season of the year and depth. Aerated stabilization basins are generally designed to remove 60 to 80 percent of the BOD, activated sludge units 80 to 85 percent, and trickling filters 40 to 60 percent.

(*5*) *Decolorization of wastes*

In the treatment of pulping wastes for suspended solids and BOD removal, one characteristic; that is, color, usually remains unchanged. The brown color of pulping effluent is due to the presence of lignins and tannins dissolved from the wood during digestion and bleaching. Persistence of color downstream in the receiving waters is due to the resistance of these compounds to microbiological degradation.

The importance of color, although largely aesthetic, also involves technical considerations in connection with its possible effects on water treatement for public water supplies and on process water quality.