advanced process because it is not conventionally applied to the treatment of municipal waste effluents and because the efficient removal of suspended and even colloidal solids is a necessary pretreatment for many of the other advanced processes.

Assuming a good quality secondary effluent, 50-100 mg./l. of alum or perhaps 200-300 mg./l. of lime are required to remove suspended and colloidal solids and phosphates. Standard water treatment flocculation tanks and sedimentation basins would be used. The capital cost for this type of treatment will be less than $.10/daily gallon capacity for plants of the 10-20 million-gallon-per-day scale and about $.05/daily gallon capacity for 100 mgd plants. Operating costs, including capital amortization at 6 per cent interest for 20 years, will be about $.08/1,000 gallons at 10-20 mgd and $.05/1,000 gallons at 100 mgd exclusive of sludge disposal.

After removal of colloidal and suspended solids, the soluble refractory organics may be very efficiently removed by contact with activated carbon granules. Such carbon will adsorb up to 20-30 per cent of its own weight in mixed organics from waste water when used in counter-current flow fixed-bed contactors. At a mass velocity of 7 gal./min-ft.^{2} and a contact time of 40 minutes, more than 98 per cent of both BOD and total organic matter will be removed. To minimize cost, the activated carbon should be regenerated and reused. Fortunately, thermal regeneration of activated carbon following saturation with actual waste organics has been possible. A series of 15 successive saturation-regeneration cycles were performed with satisfactory regeneration efficiencies. This process is being studied in a 300,000 gallon-per-day pilot plant at Pomona, California, under a joint research project of the FWPCA and the Los Angeles County Sanitation Districts. The process also has been used since last summer in actual municipal service in a 2.5 mgd plant of the South Tahoe Public Utility District at Lake Tahoe, California.

The capital costs for an adsorption plant of 10-20 mgd capacity should be about $.15/daily gallon capacity and at 100 mgd, about $.09/daily gallon. Operating costs, including 20-year capital amortization at 6 per cent interest, should be less than $.10/1,000 gallons for a 10-20 mgd plant and about $.06/1,000 gallons at the 100 mgd scale.

Except for dissolved inorganic salts added during use, municipal waste water subjected to the foregoing treatment procedures in sequence will have been restored to a chemical quality generally comparable to that before use. As stated earlier, the salts added during one pass through a municipal system will normally total about 300-400 mg./l. (TABLE 1). Since many water supplies contain these same dissolved salts at approximately this concentration, one municipal use of water generally doubles the salt content. Fortunately, a single-pass electrodialysis reduces the concentration of dissolved inorganic solids by 40-50 per cent, the same percentage required to remove the increment of mineral pollutants added during use.

Extended bench-scale tests and operating pilot-scale studies at 75,000 gpd have established that the power requirements for electrodialysis of municipal waste water are only 6-10 kwh./1,000 gallons. For "typical" waste waters (TABLE 1), polarization can be avoided if a current density-to-concentration ratio of 750 (ma./cm.^{2})/(g.Eq./l.) is not exceeded. Under these conditions, effective cell-pair area requirements are less than 0.004 ft.^{2}/gpd. Concentration ratios greater than 10:1 can be readily achieved with proper pH control; ratios of 50:1 have even been attained.