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PROSPECTS OF ACTIVATED SLUDGE PROCESS IN JAPAN - ITS PAST, PRESENT, AND FUTURE-

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ABSTRACT

Activated sludge process was proposed in 1914 to purify BOD substances and to nitrify ammonium-nitrogen. Its concept consisted of the addition of activated sludge (humus) to sewage, aeration and settling of mixed liquor for decantation and reuse of activated sludge. This process was adopted in a short period to treat the municipal wastewater in the world. After that various processes were proposed in addition to the conventional activated sludge process for energy saving, advanced nitrification and so on. Then, the activated sludge process was modified to treat the industrial wastewater in the period of highly economic growth. The concept of acclimation or adaptation of activated sludge to the specific industrial wastewater was established during the development of new processes. And also the concept of the scale-up of activated sludge process was made in practice. For instance, sludge growth rate or excess sludge production rate was correlated to BOD removal rate and MLSS concentration. Also oxygen uptake rate or oxygen supply rate was expressed as an equation of both MLSS concentration and BOD removal rate. In 1970s, some researchers developed theories to control the activated sludge process or to estimate the water quality of treated effluent. Especially sludge retention time (SRT) was used widely for design and operation of activated sludge process. Monod's equation was also applied to express the quality of effluent in correlation with sludge growth rate. Purification model of activated sludge process was also proposed and then modified to estimate the behavior of the process much accurately. Persistent materials were new targets for COD removal in Japan to attain the environmental standard of Tokyo, Osaka or Ise Bay and Seto Inland Sea. After that nitrogen concentration was added to the new standard or regulation. Anoxic-oxic (AO) or anaerobic-anoxic-oxic (A₂O) process was then diffused in Japan to remove the nitrogen. Membrane bioreactor is also spread to treat the municipal wastewater. Recently, genetic engineering methods were applied to assess the composition of microbial communities, microbial diversity or acclimation process for treating persistent organic pollutants such as endocrine disrupting chemicals. Bioaugmentation of effective microorganisms was a new trend to absorb the shock loading like phenol and other persistent organic materials. Genetic manipulation method like DNA microarray method will be applied to assess the toxicity of effluent. Finally, it will be considered that activated sludge process is evolving continuously to solve the coming problem.