Denitrification of industrial waste water

While nitrogen regulations have grown stricter over the past few years, the presence of biological inhibitors, the lack of sufficient organic materials for use in denitrification, and other similar problems mean that there are many cases where industrial waste water cannot be treated using biological methods. At AIST, we are currently working on the problems of waste water treatment, aiming for improvement of technologies for using microorganisms in cleaning up pollution and wider applications of such technologies.

Using a membrane separation activated sludge system, we have proved that it is possible to maintain high concentrations of nitrifying bacteria with slow reproduction rates, stimulate denitrification, and reduce the amount of excess sludge generated. We are also studying ways of performing nitrogen removal under conditions biological inhibitors exist.

Phenols are frequently found in industrial waste water, and it is said to have a strong effect as an inhibitor towards nitrifying bacteria at low concentrations of 10 mg/L. We have demonstrated the effectiveness of a system which confirms the existence of nitrifying bacteria in activated sludge acclimated to the presence of phenols and simultaneously removes phenols and ammonium from waste water in which both (phenols and ammonium) are found. A view of this system is shown in Figure 1. We were successful in achieving complete decomposition of phenols and the removal of 60% of the nitrogen under a phenol load of 0.3 g/L/d and an ammoniac nitrogen load of 0.2 g/L/d.

Dimethylformamide (DMF) is a persistent substance which requires acclimatization in activated sludge treatment. Furthermore because it is a nitrogenous compound, ammonium and nitric acid remain in the waste water, and it is necessary to add nitrogen treatment. We treated synthetic DMF waste water with a concentration of organic materials of 910 mg/L (nitrogen concentration: 122 mg/L) by a membrane separation nitrification/denitrification process with intermittent aeration using acclimated activated sludge. By adjusting the number of times processing was performed and setting an upper limit on the concentration of dissolved oxygen at the time of aeration, we demonstrated that it is possible to remove nitrogen using DMF as an organic source. In this way, the effective use of organic materials in waste water, which are not normally utilized, would also make it possible to reduce the cost of treatment.

Plans now call for these experimental results to be used in an attempt to develop an actual water treatment and control system.

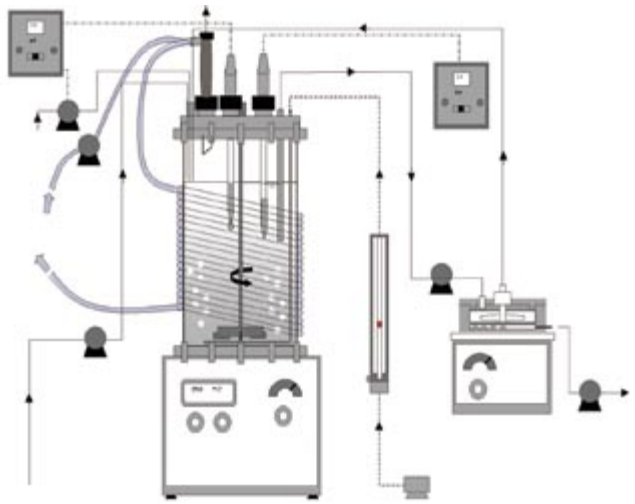


Fig. 1 An experimental setup of membrane separation reactor

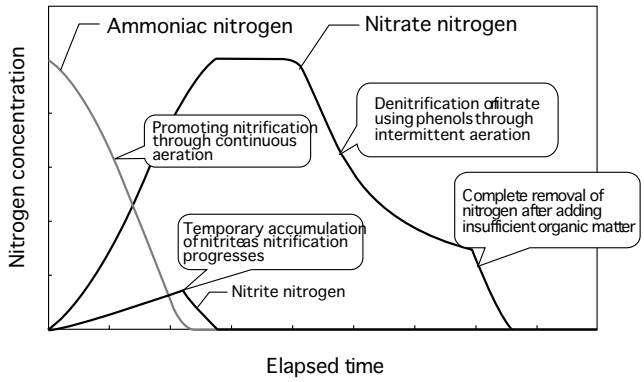


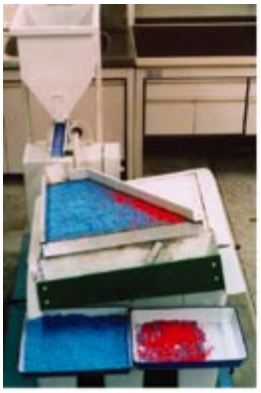
Fig. 2 Removal of nitrogen by modification of aeration methods using a single-vessel reactor

Experimental results obtained by phenol-ammonium treatment reactor

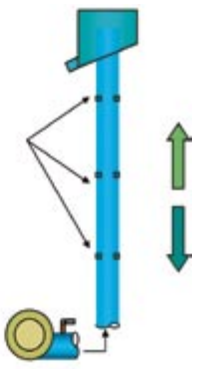
Recycling technologies

Particle separation technologies

While technologies for the separation and recovery of particles are used in a wide variety of production processes, such technologies are also important in the field of environmental preservation for the recycling of useful materials from wastes or used products or for the waste water treatment to remove particles and purify water. One example of this need can be seen in dry particle separation technologies, which present advantages such as being energy-saving and which require no post-processing waste water treatment and are thus suited for use in recycling but which are also considered to be inferior to wet process in terms of their efficiency in separating fine particles. It is



(a) An air table type separator



(b) A pneumatic column separator

Fig. 1 Dry particle separators