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Removal of Boron from Wastewater by *N*-Methylglucamine-type Cellulose Derivatives

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It is still general that synthetic polymers are used as adsorbents for metals. However, adsorbents, derived from natural polymers, are desired in the viewpoints of technology well-adapted to the environment for realization of sustainable society.

Boron has virulence for reproduction and causes disease for nervous system. Therefore, removal of boron from wastewater is important for environment control. To obtain adsorbents for boron derived from natural polymer, three forms (powder, fiber and

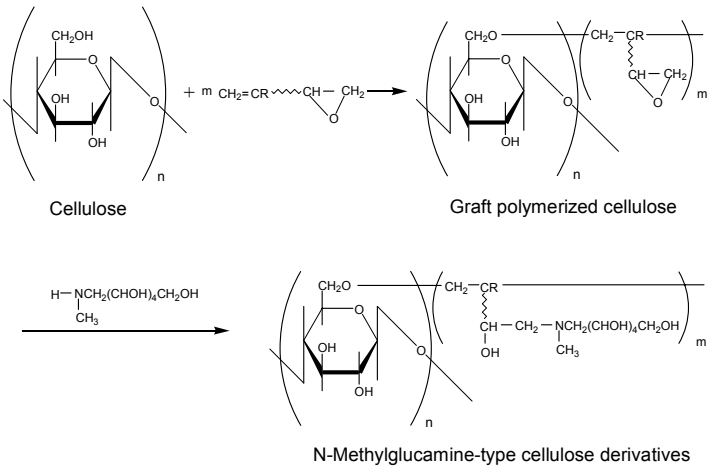

Fig.1 Synthesis of *N*-methylglucamine-type cellulose derivatives

cloth) of *N*-methylglucamine-type cellulose derivatives were synthesized. After the graft polymerization of three forms of cellulose with vinyl monomer having epoxy groups, the *N*-methylglucamine-type cellulose derivatives were obtained by the reaction of the grafted cellulose with *N*-methylglucamine, as shown in Fig. 1.

Commercially available *N*-methylglucamine-type polystyrene resins were known as adsorbents for boron. The cellulose powder also adsorbed boron, as shown in Fig. 2, at the same levels of adsorption capacities as a *N*-methylglucamine-type polystyrene resin. The cellulose powder and fiber adsorbed boron more quickly than the polystyrene resin in a batch method. At a high flow rate of space velocity 75 h^{-1}, the breakthrough point of boron in the cellulose fiber column was greater than that in the polystyrene resin column in weakly basic media, as shown in Fig. 3. The boron, adsorbed on the cellulose column, was quantitatively recovered with diluted hydrochloric acid in 20- and 200-fold concentrations. In addition, the batch and column methods using the cellulose derivatives could be applied for the quick removal of boron from actual wastewater. Consequently, it was found that the cellulose derivatives were superior to the polystyrene resin as adsorbents for boron in treatment of a large quantity of wastewater.

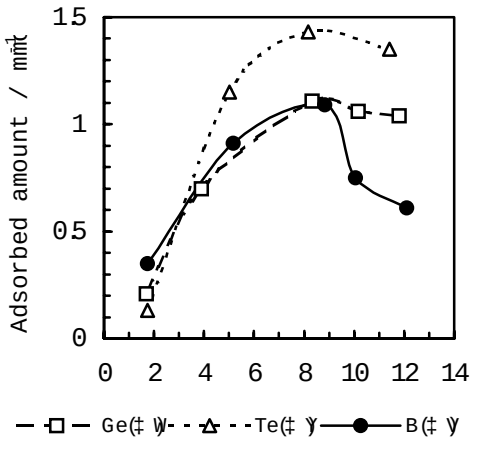

Fig. 2 Effect of the pH on the adsorption of boron on the cellulose powder

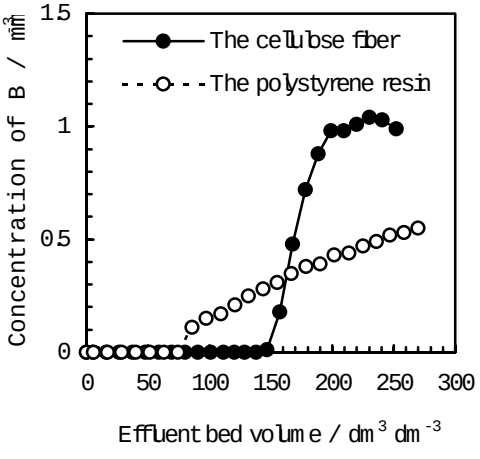

Fig. 3 Breakthrough curves for boron using the cellulose fiber and the polystyrene resin columns