Characterization Method of Micro-Gel Particles within Synthetic Resin Adsorbent

HIDEO HATTORI
Research & Development Section, Genesis Research Institute, Nagoya, Japan

HIDEAKI NAGAHAMAYA
Department of Applied Chemistry, Meiji University, Kawasaki, Japan

KIYOHIKO TAJIMA
Research & Development Section, Genesis Research Institute, Nagoya, Japan

EIJI FURUYA
Department of Applied Chemistry, Meiji University, Kawasaki, Japan

Abstract. Now, it is demanded to work on environmental preservation and avoidance of resources exhaustion. For resolutions of these problems, it is noticed biorefinaly, which means producing various fuels and utility substances systematically as materials which is biomass produced a process of elementary cycle in the natural world. So, in this study it is aimed saccharides which are produced largely in the biomass. In the saccharides, development of methods for using D-Glucose or D-Fructose which is an isomer of D-Glucose, which composes cellulose, starch and so on, is an important subject. A reaction of D-Fructose in the presence of acids has been known from the old days. It is necessary to derive purposive products selectively for obtaining ones. Conventionally, these kinds of complex reactions have been controlled by temperature, time, pressure, solvent(s) and catalyst(s). But it is difficult to obtain specific compounds selectively by complicated reactions of saccharides. So, as a new control method of these reactions, to obtain purposive products selectively and efficiently by absorbing specific compounds onto an adsorbent from many products which are concerned with the reaction was tried.

As well known, D-Fructose is decomposed to Levulinic and Formic acid via 5-hydroxymethyl-furfural (HMF) in concentrated hydrochloric acid. In the course of the reaction, HMF molecules are converted to ethereal dimer by dehydration. It is noted from previous experimental results that HMF dimer can be recovered from HMFs mixture by use of adsorption technique. But some amounts of molecules adsorbed within synthetic resin particles can not be desorbed by a solvent extraction technique.

The amount is called “amount adsorbed irreversibly” after here. In the case when so-called “amount adsorbed irreversibly” is very larger, adsorption efficiency might be getting down. It has been concluded from the previous results with respect to styrene-divinylbenzene adsorbent that amount adsorbed irreversibly is dependent on the crosslinking degree but significant relationship between the amount and the degree was not obtained. Then, new physical property has to be employed to determine suitable adsorbent particles for HMF dimer recovery. As mentioned in previous paper, amount adsorbed irreversibly seems to be due to sorption within micro-gel particles.

In this paper, determination procedure of micro particle properties is focused on. Spaces between micro-particles within the sorbent particles are called “macro-pore” and spaces within the micro-particles are called “micro-pore”. The micro-pore volume was determined by use of vaporization procedure using carbon tetrachloride. It is came clear from the experiments that the volume was dependent on the crosslinking degree as listed in the table and the amount adsorbed irreversibly is a function of the micro-pore volume. Finally, it is concluded that the optimum adsorbent for the selective adsorption of HMF dimer can be determined base on the micro-pore volume.

Table.1 Value of micro-pore volume

crosslinking degree[%]	20	40	55	80	98
space volume[$cm^3/g_{-adsorbent}$]	0.0207	0.0252	0.0376	0.0944	0.1034