ABSORPTION-DESORPTION ISOTHERMS AS A TOOL FOR ESTIMATION OF CONDITIONS FOR AFTER-TREATMENT OF DEACIDIFIED CELLULOSIC OBJECTS

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Mass deacidification of cellulosic objects of cultural heritage, particularly old books, is still a serious problem. Recently, we briefly discussed the most commonly used deacidification procedures[1]. As indicated there, after the deposition of a deacidifying agent (inorganic; such as MgO, $Mg(OH)_2$, $CaCO_3$, etc.; or organic, e.g. $Mg(OCH_2CH_3)$, the next important step is "after treatment". This step is performed at such a water humidity and temperature for a certain time (usually days, even weeks), which allow a sufficient swelling of structure by absorption of water. Consequently, deacidifying components (e.g. Mg^{2+} and OH^-) can penetrate (diffuse) to domains close to polymeric cellulose chains, neutralize acidic species and the so-called alkaline reserve can be generated. Optimization with respect to the minimum time of the deacidification process and the potential damage of the object by wetting and corrugation after drying is required. In industrial practice, the conditions for "after treatment" are estimated by experimental optimization.

When the water activity ($a_w = p_w/p_w^0$) is low or moderate ($a_w < 0.5$), absorption of water and swelling of bundles of cellulosic polymer chains take its course inside a (micro)porous structure. During this period, the overall volume of a cellulosic object does not change significantly. After increasing water activity, the amount of absorbed water increases rapidly, macrostructure expands, that is, the object, for example, a book page increases its size[2,3]. Water adsorption/absorption-desorption model isotherms, mainly the GAB type, at different temperatures reliably describe these phenomena[4].

This contribution compares absorption/desorption models and their ability to estimate optimal conditions for the "after treatment" of deacidified cellulosic objects.

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