

A COMPARATIVE INVESTIGATION OF THE IR SPECTRA OF A CARBOHYDRATE SERIES

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ABSTRACT

The IR-Fourier spectra of a series of carbohydrates whose molecules contain pyranose rings interconnected by α -1,4-glycosidic chemical bonds are recorded and compared. The compounds studied include oligosaccharides from maltose to maltoheptaose, amylose, amylopectin and several samples of starch. The main difference found in the spectra studied relates to the dominant lines in the range of 960 cm^{-1} - 1060 cm^{-1} referring to two Gaussian components. Most probably, one of them corresponds to the stretching vibrations of α -glycosidic bonds, while the other relates to the complex of C-O, C-C, and C-O-H vibrations. The ratio of the two components values depends on the glycosidic bonds and pyranose rings number in the sugar molecules and can therefore be used to characterize the degree of carbohydrates polymerization. The comparison of the IR-Fourier spectra of starch, amylose, and amylopectin in the range investigated shows that the former is much closer in its character to amylose than to amylopectin. There are spectral lines which are almost indistinguishable from those of amylose, which suggests that they refer to weakly branched forms with a prevalence of identical glycosidic bonds.

Keywords: IR-Fourier spectrum, carbohydrate, oligosaccharide, glucose, starch, α -1,4-glycosidic bond, pyranose ring.

INTRODUCTION

A carbohydrate is any representative of a large group of compounds that contain carbon, hydrogen, and oxygen and have the general formula $C_x(H_{20})_y$. Carbohydrates (monosaccharides, oligosaccharides, polysaccharides) are an important source of energy: they are produced by plants and entering the body of animals and humans through food being one of the three main components of food. All carbohydrates are ultimately broken down in the body to simple glucose sugar, which then takes part in the metabolic processes with the release of energy. The excess carbohydrates, not required by the body for an immediate use, accumulate in the liver and the muscles as glycogen. Vegetable carbohydrates are an important building material (for example, cellulose), as well as a

depot of finished products (mainly in the form of starch) [1 - 3]. Carbohydrates, despite the extremely deep elaboration of the structure and properties problems, remain an object of keen scientific interest. Recently, thanks to new research tools, additional opportunities have appeared for analyzing individual sugars.

The article presents the results of a series of carbohydrates studied by IR-Fourier transform spectroscopy, starting with maltose disaccharide and ending with high-polymer amylose, whose molecules are built from pyranose glucose rings interconnected by identical α -1,4-glycosidic C-O-C bonds, also denoted as α -(1 \rightarrow 4).

EXPERIMENTAL

Substances of brief characteristics given in Tables 1 and 2 were objects of research. The IR-Fourier spectra of