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THE THERMAL ANALYSIS OF THE LINEAR CARBOHYDRATES CONSTRUCTED OF GLUCOSE RINGS

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ABSTRACT

This article presents the results of a thermal analysis of individual linear carbohydrates, the molecules of which consist of pyranose rings interconnected by the same type of α-glycosidic bonds. It is shown that, when heated, substances first lose adsorbed and crystalline hydrate water, some of them melt, and then decompose in two stages. The amount of weight loss with carbohydrates and the temperature of their individual stages depend on the number of pyranose rings in the saccharide molecules. With an increase in the average degree of polymerization of saccharides, their heat resistance generally increases. The temperature, thermal and gravitational effects of each stage, as well as the heat resistance of saccharides depend on the number of pyranose rings in the molecules of carbohydrates.

Keywords: IR-Fourier spectrum, carbohydrate, thermal analysis, 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 which have the general formula $C_x(H_2O)_y$. Starches and sugars called carbohydrates are the main source of dietary energy [1 - 3]. Carbohydrates (monosaccharides, oligosaccharides, polysaccharides) are an important source of energy: they are produced by plants and enter the body of animals and humans with 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 [4 - 7]. Many of the carbohydrates subjected to a heat treatment in obtaining products or during the use of already produced on their base materials, for example, as a part of composites. At the same time, they undergo numerous changes and decompose. It is known that the composition of the products of thermal decomposition of the main types of carbohydrates is often extremely complex [8 - 10], and a large number of chemical reactions can occur which cause their appearance [11 - 14]. In this paper, an attempt was made to identify general patterns in the behavior when heating a number of similar saccharides, whose molecules are constructed from pyranose rings of glucose, interconnected by α-glycoside bridges of C-O-C. In this case, we did not focus on the details of the question concerning the nature and composition of the products of thermal decomposition of carbohydrates. The task of this study was to establish how the average degree of polymerization in linear saccharides affects the temperature thresholds of their transformations and the magnitude of thermal effects.

EXPERIMENTAL

Carbohydrates with a polymerization degree of 2 - 7, as well as glucose and high polymer amylose were tested (Table 1). Some commercial characteristics of the examined compounds are given in the table. For the study of the sugars a device combined thermal analysis STA 449 F3 Jupiter Netzsch company was used. Samples weighing