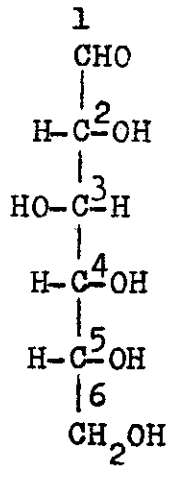
CHAPTER I

INTRODUCTION

1) Chemical Structure:

The product of plant assimilation and presumably the only one form which all other plant material will be described by enzymatic conversion in the living cells of the plant has been established to be glucose. Glucose (I) has the chemical composition $C_6H_{12}O_6$, which corresponds to one molecule of water per atom of carbon. Substances with such a composition have therefore been named carbohydrates.

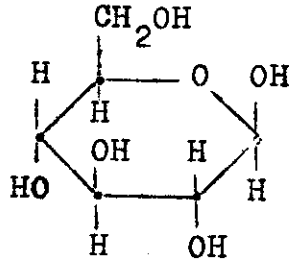


(I)

Glucose has an aldehydic group and is therefore an aldose. It easily forms a hemiacetal linkage between the aldehydic group and the C-5 hydroxyl group. The resulting

six-membered ring has the basic structure of pyrane. With the formation of the C-1 to C-5 acetal linkage, the C-1 atom becomes asymmetric and two different forms exist, one showing the hemiacetal group to the left (alpha), and the other to the right (beta).

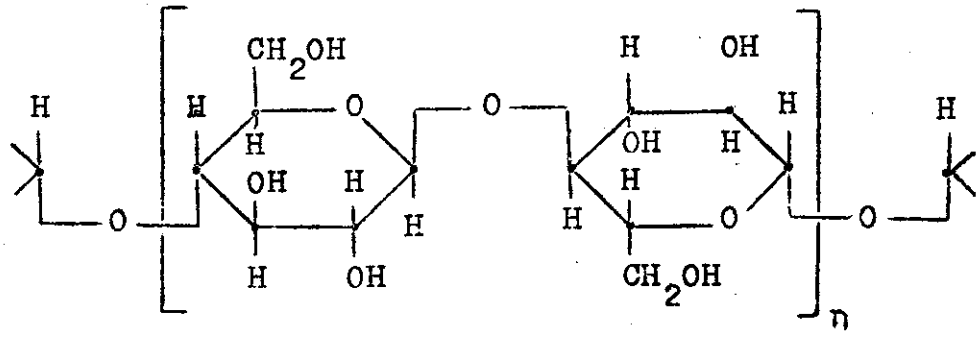
Haworth[1] has introduced the method of writing the sugars linked by hemiacetal groups in the ring form (II) which has greatly facilitated the understanding of their reactions.



(II)

The elementary unit of a cellulose macromolecule is anhydro-d-glucose, $C_6H_{10}O_5$, which is repeated a great number of times in the cellulose molecule, i.e., cellulose is a high molecular compound. Evidence that the units of a cellulose macromolecule are anhydro-d-glucose is that 96-98% of d-glucose is obtained in cellulose hydrolysis.

It follows from the aforesaid that the cellulose macromolecule may be represented as follows:



The end units of the cellulose macromolecule chain differ somewhat in composition from the middle glucose units. One of the end unit ($C_6H_{11}O_6$) has an aldehyde group, while the other end unit ($C_6H_{11}O_5$) contains four hydroxyl groups. As the cellulose macromolecule is very long and contains 30,000-45,000 functional alcohol groups, the appearance of two new functional groups at the end of the chains does not influence the chemical properties of cellulose, which are mainly dependent on the functional groups in the middle portion of the molecule.

2) Graft Copolymerization of Cellulose:

The physical structure of cellulose, can be changed by treating native cellulose to render it soluble and then