



## Dialdehyde Starch-Lysine Conjugates: Chemical, Structural and Functional Properties

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### ABSTRACT

We produced a novel starch derivative in two steps: periodate oxidation to obtain dialdehyde starch (DAS) and conjugation of DAS with lysine in a Maillard-type reaction. Compared to the native tapioca starch, DAS has significantly lower intrinsic viscosity, molecular weight, relative crystallinity, smoothness of granule surface, and swelling power, but higher solubility and light transmittance. When produced using increasing periodate concentrations from 0.05 to 3.0 N, DAS had higher carbonyl contents and swelling powers but lower recovery efficiency, intrinsic viscosity, relative crystallinity, and solubility. When produced from DAS with higher carbonyl contents, the DAS-lysine conjugates had higher degree of lysine conjugation and swelling power but lower intrinsic viscosity, relative crystallinity, granule integrity and paste transparency. This approach of conjugation can be used in slow-release applications, where different amino acids, peptides, or even proteins can be conjugated with DAS, and then cleaved and released in the stomach or other acidic media.

**Keywords:** Dialdehyde starch, Amino acid conjugation, Periodate.

### INTRODUCTION

In industrial applications, native starch exhibits many disadvantages in terms of technological properties. Therefore, food scientists and technologists have modified starches to change and improve their technological, physicochemical, chemical and digestive properties. There are three groups of starch modification techniques including chemical, physical and enzymatic treatments. At present, chemical modification is the most widely applied group of techniques. Chemical modification methods include oxidation, cross-linking,

esterification, etherification and cationization<sup>1</sup>.

Many oxidizing agents have been used for starch oxidation, such as  $\text{ClO}_2^-$ ,  $\text{ClO}^-$ ,  $\text{H}_2\text{O}_2$ ,  $\text{O}_3^{2-}$ ,  $\text{IO}_4^-$ ,  $\text{MnO}_4^-$ ,  $\text{Cr}_2\text{O}_7^{2-}$ ,  $\text{S}_2\text{O}_8^{2-}$  and  $\text{O}_3^{2-}$ . In an acidic medium, periodate ( $\text{IO}_4^-$ ) selectively oxidized and split the C-2 and C-3 bonds of the glucose units of starch with the formation of carbonyl (aldehyde) groups at those sites<sup>2</sup>. In an alkaline medium, periodate oxidizes starch to form carboxyl groups with three mechanisms: (1) Cannizzaro reaction converting two aldehyde groups to a hydroxyl group and a carboxyl group, (2) a series of reactions begun



# Dialdehyde Starch Analytical Report

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## **Dialdehyde Starch Analytical Report:**

Industrial Biotechnological Polymers Charles Gebelein, Charles E. Carraher Jr., 1995-10-10 From the Preface This book attempts to delineate some of the more recent efforts at utilizing biotechnology in industry For convenience this book is divided into the following five sections 1 Industrial Applications 2 Polysaccharides and Lignins 3 Spider Silks 4 Protein Based Systems and 5 Miscellaneous Biotechnological Polymers The division is intended for the convenience of the reader and not to depict any basic demarcation in biotechnology which already spans much of our modern technology and appears poised to embark on a course aimed at extending its boundaries even further One of the newest trends in science is the mimicking of nature using solutions provided in nature such as elasticity to produce materials with distinctive properties The papers in this book are extensions of presentations given March 15 16 1994 in San Diego at the 207th National Meeting of the American Chemical Society during a symposium on Industrial Biotechnological Polymers This symposium was sponsored by the Biotechnology Secretariat and cosponsored by the A C S Division of Polymeric Materials Science and Engineering The editors believe this book will make a lasting contribution to the field of biotechnological polymers **Journal of the American Chemical Society** American Chemical Society, 1957 Issues in Global Environment: Biodiversity, Resources, and Conservation: 2011 Edition , 2012-01-09 Issues in Global Environment Biodiversity Resources and Conservation 2011 Edition is a ScholarlyEditions eBook that delivers timely authoritative and comprehensive information about Global Environment Biodiversity Resources and Conservation The editors have built Issues in Global Environment Biodiversity Resources and Conservation 2011 Edition on the vast information databases of ScholarlyNews You can expect the information about Global Environment Biodiversity Resources and Conservation in this eBook to be deeper than what you can access anywhere else as well as consistently reliable authoritative informed and relevant The content of Issues in Global Environment Biodiversity Resources and Conservation 2011 Edition has been produced by the world s leading scientists engineers analysts research institutions and companies All of the content is from peer reviewed sources and all of it is written assembled and edited by the editors at ScholarlyEditions and available exclusively from us You now have a source you can cite with authority confidence and credibility More information is available at <http://www.ScholarlyEditions.com> *Mineral-Filled Polymer Composites Handbook, Two-Volume Set* Hanafi Ismail, S. M. Sapuan, R.A. Ilyas, 2022-07-30 Mineral filled polymer composites exhibit several advantages that make this material class attractive for a variety of applications including their low cost light weight excellent rigidity and high mechanical strength Mineral Filled Polymer Composites Handbook serves as a comprehensive overview of the latest research trends applications and future directions of advanced mineral fiber reinforced polymer composites Comprised of 2 volumes Mineral Filled Polymer Composites Perspective Properties and New Materials Mineral Filled Polymer Composites Selection Processing and Applications Presents details on processing applications and ageing of macro to nanosized mineral reinforced polymer composites Examines fabrication techniques novel synthesis

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