Non-random chitosans

Process for the preparation of non-random chitosan polymers

Invention

Chitosans are a family of functional biopolymers, typically produced by partial de-N-acetylation of chitin, one of the most abundant biopolymers in the world. The unique polycationic nature of chitosans is at least partially responsible for the many bioactivities of chitosans, such as their antimicrobial, plant-strengthening, and wound-healing activities, which make them extremely valuable compounds for applications in biomedicine, agriculture, cosmetics and in the food industry. These bioactivities are deeply influenced by the degree of acetylation of the chitosan used. As an example, chitosans with a low degree of acetylation, and, as a consequence, with a relatively high density of positive charges, are particularly interesting, for example, in form of nanoparticles for drug, gene or vaccine delivery. However, the degradation of such chitosans in the human body is very slow or inexistent, as humans do not possess chitosanases, i.e. enzymes that cleave the glycosidic linkage between two adjacent GlcN units. Thus, they are found to be hardly or even not approvable by the Food and Drug Administration (FDA) for medical purposes. Humans do possess chitinases and lysozyme, i.e. enzymes that hydrolyse the chitosan polymer chain within a stretch of two or three adjacent GlcNAc residues, respectively. But as conventional chitosans are characterised by random patterns of acetylation, such acetylated stretches which could serve as cleavage sites are rare. The present invention relates to a process for the preparation of a non-random chitosan polymer, derived by using a deacetylase enzyme in the presence of acetate ions under conditions that allow acetylation of the poly-D-glucosamine by said chitin deacetylase to obtain a chitosan polymer which presents a defined, e.g. blockwise or more regular pattern of acetylation so that e.g. even chitosans with low degree of acetylation are more easily degraded by human enzymes or other advantages can be created compared to chitosans with undefined acetylation patterns.

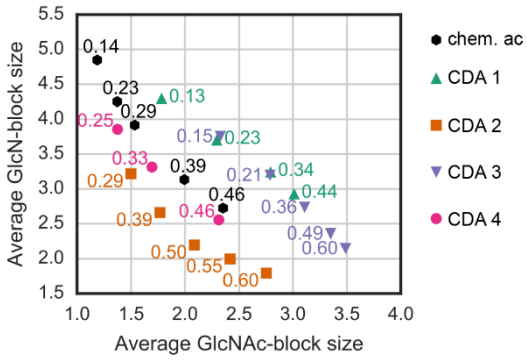

Figure shows the relationship of the average GlcN-block sizes and the average GlcNAc-block sizes of the respective chitosan polymers obtained with different chitin deacetylases

Commercial Opportunities

PROvendis is offering licenses for the invention to interested companies on behalf of the University of Muenster.

Relevant Publications

Kohlhoff M et al. (2017) Chitinosanase: A fungal chitosan hydrolyzing enzyme with a new and unusually specific cleavage pattern. Carbohydr. Polym. 174, 1121-8

Hembach L et al. (2018): Enzymatic production of all fourteen partially acetylated chitosan tetramers using different chitin deacetylases acting in forward or reverse mode. Sci. Rep. 7, 17692

An invention of the University of Münster.

Competitive Advantages

- Defined pattern of acetylation
- Easily degradable in human tissues
- Increased biocompatibility and therefore, broad range of applications
- Likely better approvable by FDA or other authorities

Technology Readiness Level

1 2 3 4 5 6 7 8 9

Technology validated in lab

Industries

- Chemical Industry
- Medical Technology
- Pharmaceutical Industry

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