

National Research and Development Programme 2001

Production and application of environment-friendly starch derivatives for the protection of the environment

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Objective of the project

The goal of the project is to develop a starch-based biopolymer product family the members of which can be used in the fields of industry, agriculture and water treatment protecting the public health and the environment.

Advantages of using such products:

- they are originated from renewable raw materials,
- they are non-toxic in case of using appropriate reagents,
- they are degrading for environmental impact.

Products

- **Flocculants**: they can be used in the clarification step of the water and wastewater treatment
 - Anionic flocculants: e.g. starch phosphates
 - Cationic flocculants: e.g. starch ether derivatives
- **Slow release encapsulating agents**: the starch esters with controlled water repellency can decrease the rate of leaching of pesticides or other bioactive components. It results in safe formula and less consumption.
- **Scale inhibitors**: starch phosphates prevent the scale formation in water lines, the heat transfer is better and the corrosion decreases.
- **Natural carriers, ion-exchangers**: for biotechnological processes.

PHYLOSOPHY

for technology development

To maximize

- **the efficiency,**
- **the selectivity,**
- **the quality of products**

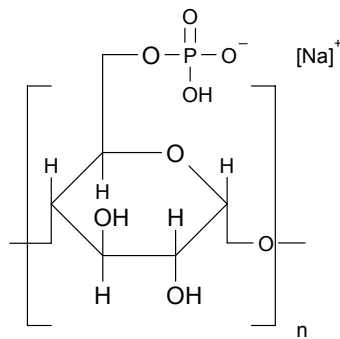
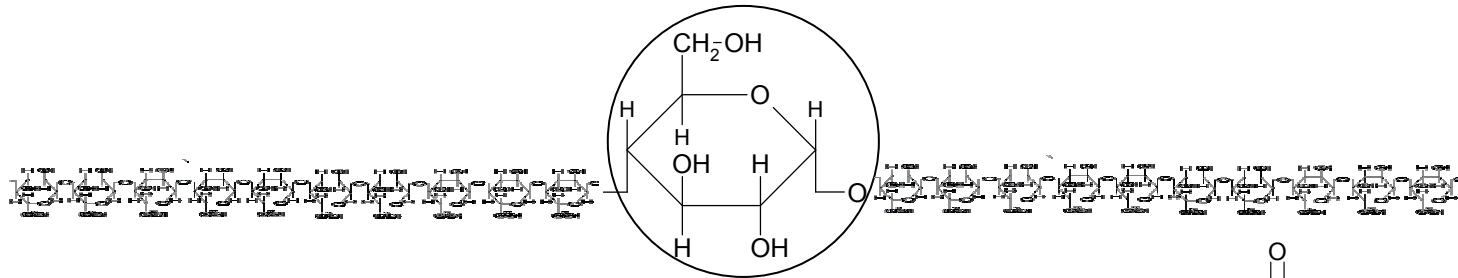
To minimize

- **the amount of wastes,**
- **the environmental and safety problems.**

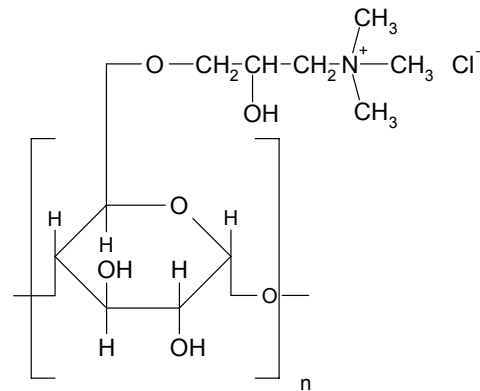
Direct and indirect impacts of the project

- **Pollution** of the environment originating from the use of synthetic polymers **can be reduced**.
- Due to the replacement of the synthetic flocculants used in drinking water treatment the consumers can get **healthier drinking water**.
- The slow release encapsulating agents directly **protect the health of workers** who use the active agent, but indirectly also that of consumers who may meet the active agents in small concentrations.
- The scale inhibitors **decrease the energy consumption** due to the better heat transfer.
- The ion-exchangers and carriers also **decrease the harmful effect of synthetic products** of similar purpose on the environment.
- The Nitrokemia 2000 Co. locating in the near of Lake Balaton wishes to **introduce up-to-date low-waste technologies** for the production of its products planned.

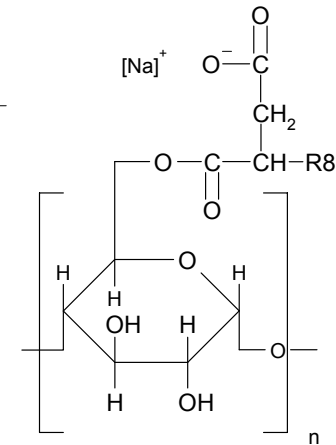
Functional character of the products



Anionic flocculant



Cationic flocculant

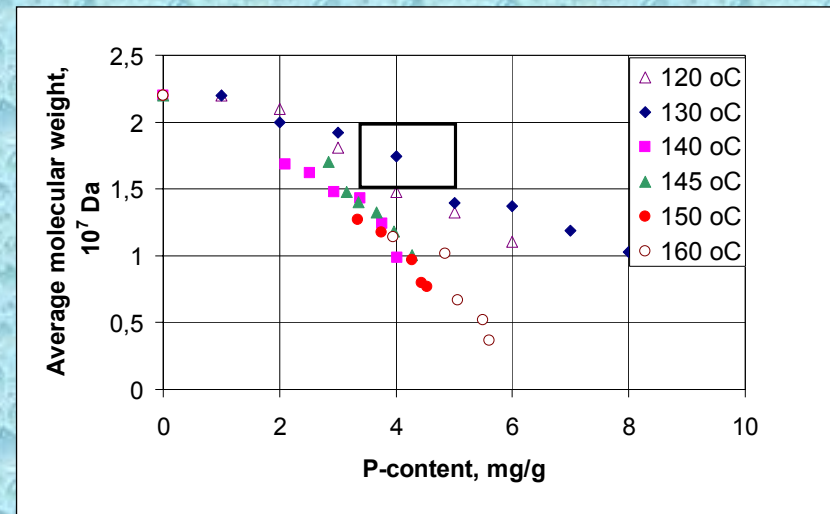
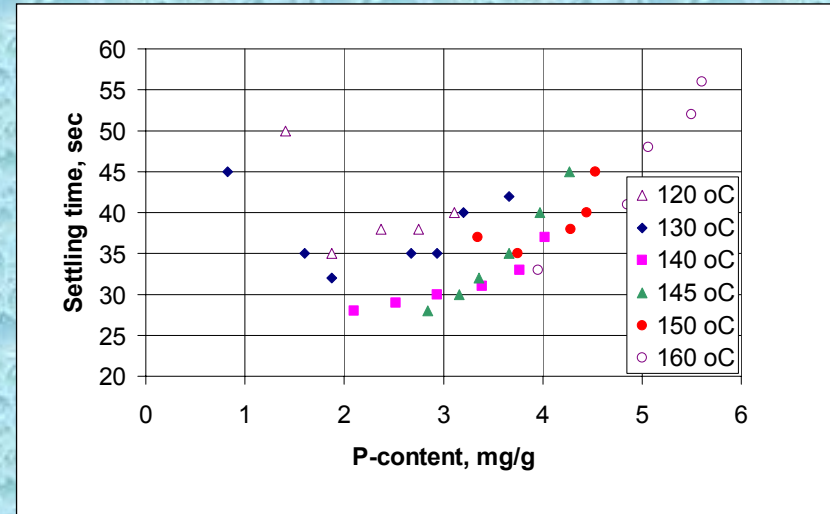


Slow release encapsulating agent

Ion-exchanger, carrier

Laboratory and industrial scale results

- **Data of the best products**
 - average molecular weight: $1.5-2 \cdot 10^7$ Da
 - P-content: 2-3 mg/g
- **Optimal technological parameters**
 - temperature: 140-145 °C
 - residence time: 60-90 min
 - Reactor with fast heating-up

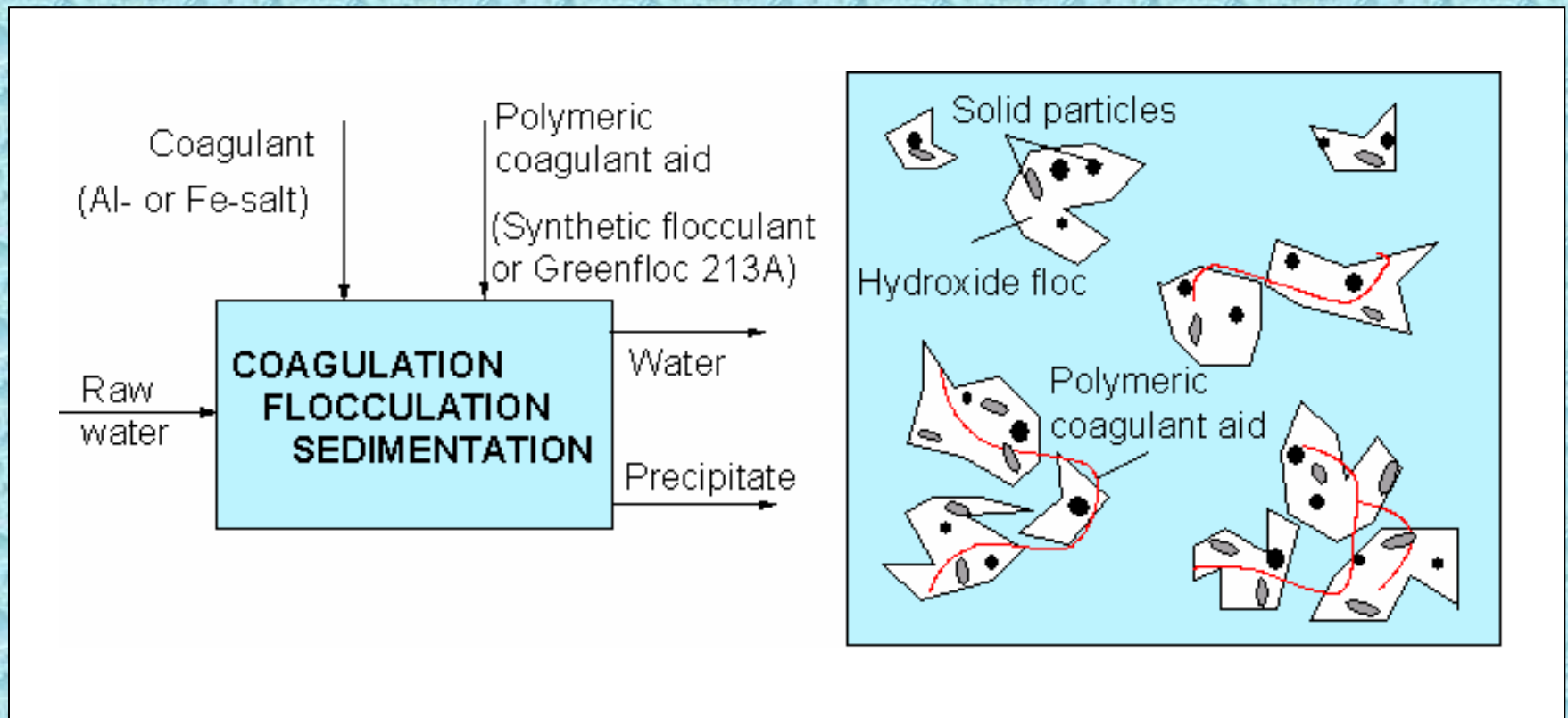


Pilot scale reactor

- **Capacity: 100 kg/charge**
- **Reactor volume: 0.45 m³**
- **Spraying:**
 pneumatic nozzle
- **Mixing:**
 horizontal impeller
- **Vacuum pump, condenser**
- **Electric heating**
- **Temperature control**



Flocculation in the water treatment



Flocculation and sedimentation

- **Sedimentation of 5 g/dm^3 kaolin suspension without and with 10 ppm starch based flocculant**
- **Dosage at industrial scale water treatment : 0,2-0,3 ppm**



0 sec



11 sec



21 sec



31 sec



41 sec



51 sec

Industrial scale experiments at Waterworks in Lázberc

We recommend our product to use it as coagulant aid in the drinking water treatment together with Al- or Fe-salt coagulant. Comparing to the traditional synthetic products we expect:

- similar algae**
- turbidity and**
- DOC removal**
- at similar cost.**

