dtd Deutscher Technologiedienst

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Technology inquiry TN 13 001

On behalf of a client, the *Deutscher Technologiedienst* is looking for R&D partners, technology providers and/or new, innovative process techniques for:

"The production of polyacrylamide / polyacrylate flocculants"

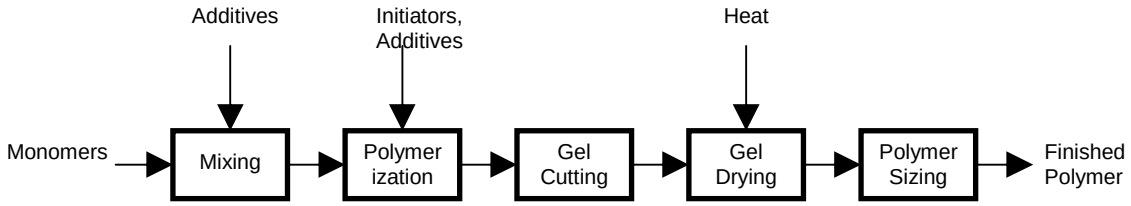
Background and description

(Keywords: Polymers, polyacrylamide, polyacrylate flocculants, polymerization reaction, polymer sizing, size reduction, investment costs, variable costs)

Polyacrylamide (PAM) products are a state-of-the-art product range for use in solid-liquid separation processes. They are available as powders and beads or in liquid form (inverse emulsions) and are extensively used in the water treatment industry (for various solid-liquid separation applications in drinking water and sludge dewatering processes), in the mining industry (for mineral extraction processes and water recovery with main application in binders and specialty flocculants), in the oilfield industry specialty (in drilling) and in the paper industry (for retention and drainage in paper and paperboard machines and in the paper mill effluent treatment process).

Synthesis of polyacrylamide

The diagram below is a simplified block flow diagram for the synthesis of polyacrylamide / polyacrylate flocculants.



The current process includes

- preparation of the monomer solutions (mixing)
- addition of comonomers for additional product properties or neutralization to create charge

-> The uniformity of the monomer components is important to the final polymer properties.

- addition of radical chain polymerization initiators

-> Uniform mixing of these initiators is key to achieving a smooth and uniform polymerization.
-> In addition, UV irradiation can be applied to facilitate the formation of radicals.

- polymerization to a gel (e.g. with a moving polymerization belt, bucket reactor or kneader reactor)

-> To achieve high molecular weights limited T_{max} and slow polymerization are required.

- size reduction in the wet gel to increase specific surface area and ease of handling (cutting, slicing, extrusion)

-> At the end of this step, the material is spongy, loosely agglomerated, somewhat sticky granular material which can be easily transferred to the drying unit operation.

- drying of the wet gel (from 50 % wet basis to 5 % or less)

-> The gel granules should be similar in size to assure uniform drying.
-> The dryer is limited to the degradation temperature of the material.

- and finally size reduction of the dried gel to achieve a small particle size with a narrow size distribution.

-> Consequently, prior to the polymer sizing step, a coarse size reduction is carried out on the dried polymer via chipping, nibbling, or other similar processes.
-> In contrast to the elastic, sponge-like behavior of the wet gel, the dried polymer is more brittle and glass-like.

The final high molecular weight polymer has a strong affinity for water and is water soluble.

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Detailed description of the required method / technique

On behalf of a client, *dtd* is looking for innovative ideas for the production of the high molecular weight polymer at a scale of 50,000 tons to 500,000 tons per year. The desired process concept will achieve one or a combination of objectives:

- decreasing capital or operation costs
  - decrease in equipment count
  - simplifying the process
- process intensification:
  - increase in yield (complete polymerization with low residual monomers remaining or reduction of yield losses due to fines removal or the evaporation of feedstock)
  - small particle size of the final polymer with a narrow size distribution (target >90% 150 microns to 650 microns)
  - less “fines” generation (minimize <150 microns)
  - improved polymer quality

You ought to consider that shortened reaction times produce low molecular weight, wide molecular weight distributions, non-uniform comonomer incorporation and higher residual monomer are all undesirable. A typical polymerization time can be on the order of 30 minutes.

Potential forms of cooperation

The goal is to modify or develop a new, innovative production process for polyacrylamide / polyacrylate flocculants. The following forms of cooperation are feasible:

- Applied R&D cooperation
- Licensing, patent or product acquisition

Required information

- Expertise / short profile of the research institute or company (approx. 1 page or link to a related website)
- Project idea or proposal (approx. 1 page non-confidential information)
- References (publication list and/or abstracts / information about intellectual property rights, patents etc.)
- Contact data