Polyelectrolytes: solution behavior and application in papermaking process

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Besides rising energy expenses, the rising material costs of raw and auxiliary materials as well as costs for the water demand represent a significant cost factor in the production of paper. Despite water is moved in cycle in the papermaking process, the addition of fresh water is necessary.
Some of the auxiliary materials in papermaking process are polyelectrolytes (PEL) used for flocculation of cellulose fibers. The PEL are added to the cellulose fiber pulp in solute state. Its quality affects the paper quality too.
The objectives of this research project are to minimize fresh water consumption as well as reducing the amount of PEL that is required for an optimum flocculation. For using polymeric additives with their maximum efficiency low recycling costs are consequentially essential to obtain a basic knowledge on PEL and their mode of action available.
A better dissolution of PEL as well as an optimized matching ratio of PEL and pulp should result in a complete conversion of PEL and cellulose. Hence, unnecessary residues and the formation of stickies in the remaining water should be avoided.
To determine the parameters which lead to optimal polymer solutions and their optimum use in the papermaking process different PEL granulates particularly based on polyacrylamide were dissolved with different technical methods (ultrasonic treatment, using a DISPERMAT® dissolver and Ultra-Turrax® etc.). Subsequently, the states of dissolving were characterized especially by rheology. The determination of storage (G´) and loss (G´´) modulus allows statements to the inner structure of the polymer solutions in terms of entanglements of polymer chains. Charge densities of the PEL in solution were determined by PEL titration based on streaming potential in each solution state.
In a second step, the dissolved PEL were tested for flocculation on cellulose / $CaCO_3$ system. The results of flocculation were assessed by centrifugal separation analysis (LUMiSizer®), turbidity, COD and TOC.

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