



## Interaction of cationic starch and dissolved colloidal substances from paper recycling, characterized by dynamic surface measurements

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### ABSTRACT

Modified starch with cationic as well as hydrophobic units can be used to remove negatively charged substances due to recycling processes of paper, so called stickies.

The interactions between different types of starch and a negatively charged model suspension, obtained by heating up common newspaper, have been studied using polyelectrolyte titration, nephelometric turbidity measurement, and determination of the carbon content. In addition, we were able to show that the dynamic interface tension is a very suitable property to characterize the surface active compounds in the model suspension which allows receiving additional information about the sticky content of the waste water.

Polyelectrolyte complexes were formed by adding cationic starch to the anionically charged model suspension. At a certain mixing ratio their precipitation leads to a significant reduction of the turbidity and the carbon content, whereas the surface tension increases due to sticky removal. Among starches with the same degree of cationic charge, those with the highest hydrophobicity were the most effective.

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### 1. Introduction

The separation of solids from suspensions via flocculation is a widely used process for waste water treatment.

Increasing use of deinked pulps in combination with the closure of paper machine circuits in pulp and paper industry processes, leads to an accumulation of so called trash material or tacky substances. These generally negative charged substances are called “stickies” which are mostly caused by synthetic polymers used in pressure sensitive label adhesives [1]. Previous articles or reviews, such as [1,2] have considered the origin, the nature, as well as the removal of such substances. For instance, the review [1] considers a variety of chemical additives that papermakers have used to bind stickies. Among them, the authors present adsorbent materials such as talc, bentonite or clay, as well as organic polymers. Within this last category there are huge ranges of molecular mass, charge, and water-loving vs. sparingly soluble character. The effects of these polymers are greatly dependent on how they interact with surfaces [1]. Important classes of polymers are cationic polymers with very high mass, acrylamide polymers (well known as retention aids), or highly charged synthetic polycations. The application of natural polymers such as starch, modified starch, or other carbohydrate polymers is described too [3–6].

Huo investigated the role of charge on the destabilization of micro-stickies and compared the strong polycation poly-diallyl-dimethyl-ammoniumchloride (PDADMAC) with commercial cationic starch. He found that the agglomeration of micro-stickies with PDADMAC occurred mainly via a charge neutralization mechanism. In contrast, the agglomeration of micro-stickies with cationic starch “had a more complicated behavior” [4].

Luo [5] prepared highly cationic starches (HCS) with different branching degrees and molecular weights. The dissolved and colloidal substances (DCS) controlling effects were investigated using zeta-potential, cationic demand, drainage speed, and turbidity. The study indicated that the degraded linear HCS had better performance in controlling micro-stickies than the branched HCS which had better performance in paper strengthening.

Glittenberg [6] studied the interactions of trash with combinations of polyelectrolytes such as PDADMAC (as trash catcher) and cationic starch (as dry strength agent) and found a synergistic effect in the direction to improve dry strength at an optimum composition of both components.

The full characterization of stickies is not easy. First, there are many different types of stickies that have to be considered [7], and second, “stickies” are not well defined products, but a mixture of different components. Therefore non of the sticky test methods investigated up to now, such as charge determination or zeta-potential measurement, was found to be universally applicable, i.e. suitable for all types of stickies.

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