# New Retention and Drainage Polymer For Carton Board and Newsprint

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## ABSTRACT

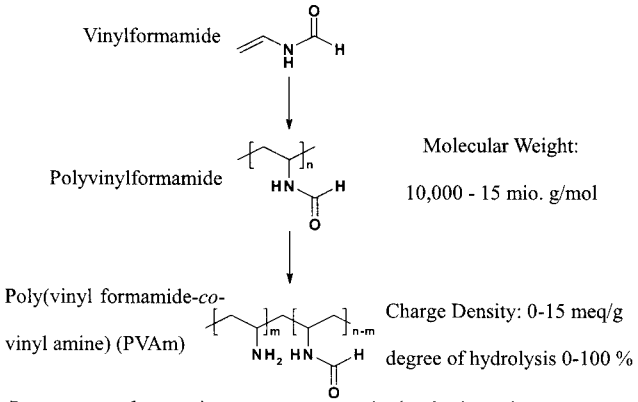
In this article, we tried to find out the potential of new PVAm (Polyvinylamine) Polymer for optimizing Retention and Drainage system. From the mill experimental in Carton board mill, we could find out PVAm can reduce a significant chemical cost with preserving Drainage. Another case of Newsprint laboratory survey, we could find out the formation benefits from optimizing PAM system to PAM + PVAm dual system.

## INTRODUCTION

*Chemistry of Polyvinylamine*

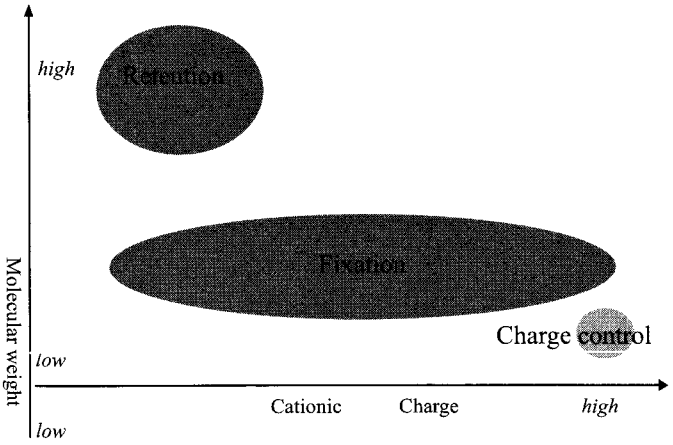
With the development of large scale synthesis of vinylformamide (VFA) by BASF a new family of polymers has become available for papermaking. The main advantage of this new chemistry is the high potential to control interactions between the polymer and different components of the paper making furnish.
VFA is polymerized to polyvinylformamide (PVFA) (Fig.1). The degree of polymerization (molar mass) can be controlled over a wide range. The molar mass range of products that are commercially available from BASF lies between 40 kD and 2000 kD.

Fig. 1. Polyvinylamine chemistry




In a second reaction step PVFA is hydrolyzed to create primary amino groups. The degree of hydrolysis can be adjusted to any ratio of amino groups and formamide groups between 0 (non-hydrolyzed) and 1 (fully hydrolyzed). At pH 7, around 65% of all amino-groups are protonated. Therefore, the reaction step that determines the degree of hydrolysis also determines the polymers cationic charge density at a given pH. The cationic charge density of fully hydrolyzed PVFA (=polyvinylamine, PVAm) at pH 7 is 15 meq/g. Lower charge densities can be obtained at lower degrees of hydrolysis. For reasons of simplicity, all partially hydrolyzed PVFA will be named PVAm.

Fig. 2. PVAm product range




An overview of commercially available PVAm based polymers in terms of molar mass, charge density and application is displayed in Fig. 2. Because of it's highly flexible synthesis, PVAm can be tailored for specific applications. For example, a low molecular weight and high charge density PVAm has been used usefully in charge control. Retention aids, on the other hand, are usually high molar mass polymers with a lower charge

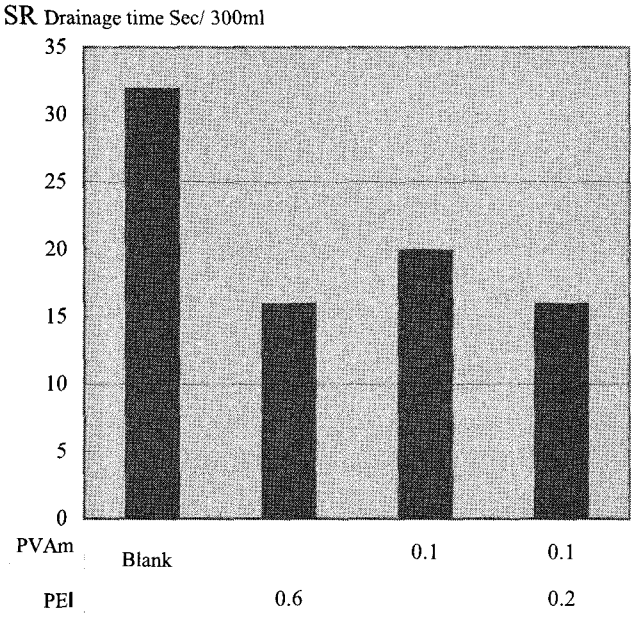
density. The polymers for use as fixing agents cover a large spectrum of molar mass and charge density, depending on the system at hand. The wide PVAm portfolio therefore allows for the tailoring of PVAm systems to address the different challenges in the papermaking process.
In this paper, we will first briefly discuss the mill cases with PVAm Water-in-Water emulsion products applied for Retention and Drainage purposes. We could find out the positive effects on Retention, Drainage and formation improvement from this application. This will be supported with two retention mill cases.

## EXPERIMENTAL

*Carton Board*
*Newsprint*

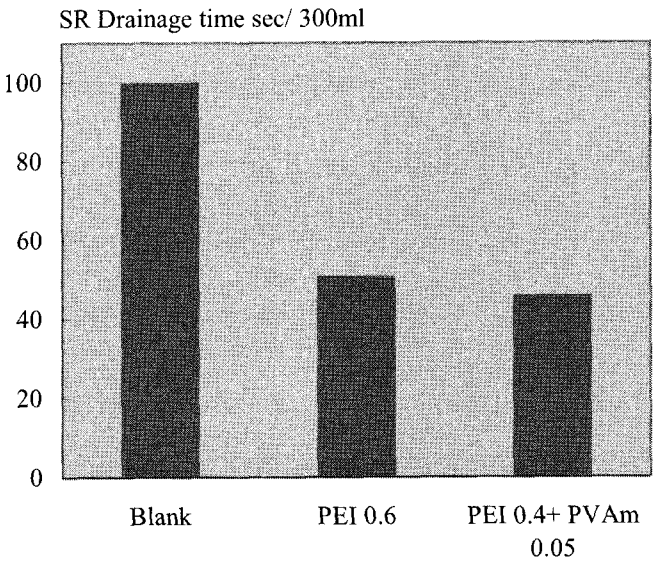
Firstly we will look at a mill case study where a Water-in Water PVAm emulsion grade was combined with PEI to improve cost performance for the customer. In this case the production grade was high basis weight, multi-layer Carton Board. The target was to maintain current conditions in terms of machine speed, productivity and sheet quality, whilst achieving significant cost savings for the application.

Fig. 3. PVAm lab test for middle layer (OCC) : Addition unit %



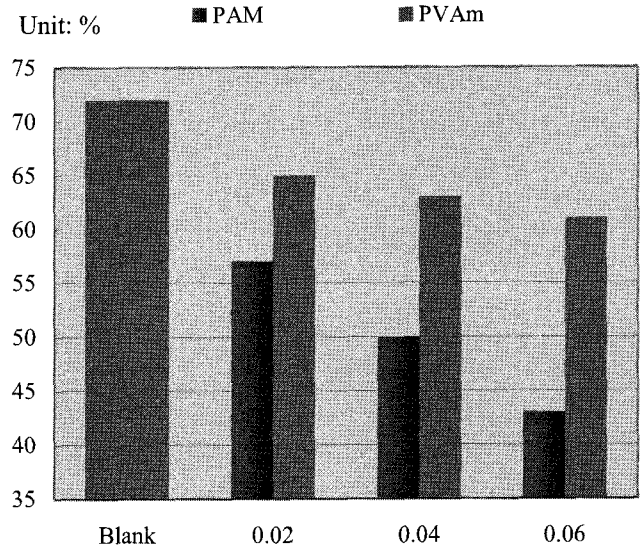

Through careful optimization steps from mill trial, it was possible to reduce the PEI additive by around 50% by substituting with the PVAm grade. This resulted in cost savings for the overall retention and drainage system in the order of 35% per annum. This was done without any detrimental effects on production output of the board machine whilst retaining the expected quality parameters.

Fig. 4. PVAm mill trial for middle layer (OCC) : Addition unit %



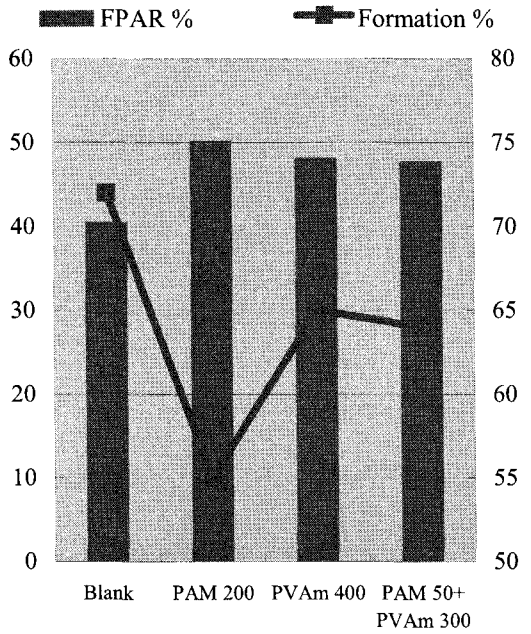

In the second mill case study, we will review the positive effects seen on formation in the production of standard off-set Newsprint (100% DIP). When introducing PVAm Water-in-Water emulsion grades in combination with Cationic Polyacrylamide, we can achieve improvements in formation whilst maintaining similar levels of retention and drainage. It is well known that the use of Polyacrylamide (PAM) will have a negative impact on formation due to their high molecular weight structure.

Fig. 5. Formation test by hand-sheet: Addition unit %




By combining PVAm with PAM it is possible to replace some of the function of the PAM relating to filler retention and drainage. As such, the lower addition of PAM required has a significant bearing for improved sheet formation values. (Fig 6.)

Fig 6.PVAm mill trial for PAM optimization:
Addition unit ppm




These advantages can be realized at no extra cost to the customer in regard to chemical application costs. The improved formation can also lead to better performance of the paper in the off-set printing process, with lower levels of print through and strike through.

## APPENDICES

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