Due to increasing concerns over environmental sustainability, the market for biopolymers has grown rapidly. To address these concerns, starch-based nanoparticle colloidal dispersions (referred to as biolatex® emulsions) were introduced about ten years ago to the paper industry as substitutes for conventional latex coating binders. It has been reported that the biolatex binder has the ability to replace up to 50% conventional synthetic binders in a coating formulation while generating comparable or even better coater runnability and paper printability. It is stated that aqueous biolatex emulsions are composed of water swollen crosslinked nanoparticles which can de-swell and deform under high shear rate. This unique ability has been shown to result in better shear-thinning behavior under high shear rates, as well as enhanced water retention and lubricating abilities than a coating containing only a conventional synthetic latex binder system.

Although curtain coating has been applied in the papermaking industry for decades, it recently regained its popularity by being adapted to produce a wide range of paper grades at high speeds. It is reported that high speed curtain coating technology has been used to coat not only various grades of paperboard but also specialty paper, printing paper, graphic paper, etc. As a contour coating technology, curtain coating is able to produce paper/paperboard having superior properties compared to other coating
technologies mainly owing to its uniform coating coverage. Numerous studies have been done to improve this technology, from process improvement to coating modification.

In this study, coatings containing 25%, 35% and 45% (wt. %) of conventional latex replaced with biolatex binder were formulated with the addition of three different special additives, Sterocoll, crosslinker B and crosslinker G (proprietary). The initial purpose of adding these special additives was to improve the stability and runability of curtain coater by increasing the curtain stretchability. At first, the rheological properties of all coatings were measured, including Brookfield viscosity, elasticity ($G'$) and viscoelasticity (tan δ), shear viscosity under the shear rates ranging from 10$^{-3}$ to 4355 s$^{-1}$, and CaBER (Capillary break-up extensional rheometry) extensional viscosity. The different influences of those special additives on the rheology of coatings containing different levels of biolatex were revealed at the first time. In addition, a new method to estimate coating strechability by running squeeze/pull-off test on a stress-controlled rheometer was demonstrated and proved to be efficient.

In the second study, the same coatings were further characterized in terms of dynamic and static surface tension by using a maximum bubble pressure method. Together with the results from previous coating characterization, several promising coatings were selected and tested on a slot-fed curtain stability tester. It was found that the addition of crosslinker B in the coatings with 35% and 45% (wt. %) latex replaced with biolatex can form the most stable curtain. With the respective addition of Sterocoll and crosslinker G, the selected coatings containing biolatex binder also resulted in good curtain stability which was comparable or even better than that of the coatings with only conventional latex and Sterocoll. Furthermore, the contribution of different coating characteristics to the curtain stability was clarified too. Last but not the least, the selected promising coatings were further evaluated on a pilot slide-fed curtain coater. Their curtain stability on this type of coater was studied, as well as their coatability on a pre-coated paperboard. The properties of the coated paperboard were evaluated, which helped optimize the formulation of coating containing biolatex binder for the commercial production in the near future.