CALCIUM SULPHATE AS COAGULANT IN PHASE OF SUGAR BEET JUICE CLARIFICATION - METHOD OF MEASUREMENT RESIDUAL SOLUTION TURBIDITY AND ZETA POTENTIAL

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Abstract

Clarification of raw sugar beet juice and molasses are important operations which are used to remove pectin and protein substances in order to obtain the final product - white sugar. Separation of these undesirable compounds in our country mostly done by CaO. The binding affinity of calcium ions (from CaO) with pectin and protein substances is low and needs large amounts of CaO. Quantities of used limestone are 1 - 3% w/w, calculated on the beet. This may cause undesirable process of alkalization of soil in the near environment of the factory. In previous researches was shown that Ca^{2+} ions bounded with SO_4^{2-} and Cl^- anions has greater affinity to binding on than Ca^{2+} ions bonded with $(OH)^-$. The aim of this study was to compare the results of solution residual turbidity measurements with the measurements of changes of zeta potential in the pectin removal from sugar beet juice using metal salt $CaSO_4$.

The experiments were based on measurement of the zeta potential. The aim of this work was to investigate the effects of $CaSO_4$ on the efficiency of pectin separation from the sugar beet juice. Model solutions of pectin (50 cm^3; 0.1% wt.) were treated with different concentration of $CaSO_4$ (50 - 450 mg/dm^3). The pH of solutions were regulated at 7. In order to monitor coagulation process of pectin solutions in the presence of $CaSO_4$, were used two methods: measuring the residual solution turbidity and zeta potential measurement. Residual turbidity of the solution was determined by spectrophotometry. Zeta potential was determined by electrophoretic method. The amounts of coagulant $CaSO_4$ needed to achieve the minimum solution turbidity and charge neutralization of pectin particles (zero zeta potential) were measured and compared.

The minimum turbidity was achieved at smaller amount of $CaSO_4$ (370 mg/dm^3 or 550 mg/g pectin) required to achieve a zero zeta potential (410 mg/dm^3 or 610 mg/g pectin). In both cases, amount of $CaSO_4$ was significantly less than the average amount of CaO used in classical process sugar beet juice clarification (about 9 g CaO/g pectin). Comparing the results of residual solution turbidity measurements with the measurements of changes of zeta potential, it can be concluded that smaller amount of $CaSO_4$ is needed to achieve the minimum turbidity of pectin solution than to achieve a zero zeta potential. Therefore, it is not always necessary to bring up the value of the zeta potential to the interval 0 – 5 mV. It is enough to increase the rate of mixing in order to accelerate aggregation and sedimentation of the pectin macromolecules.

Optimum amounts of $CaSO_4$ obtained using both methods are significantly smaller than amount of used traditional coagulant CaO. Due to economic reasons and environment protection, $CaSO_4$ is recommended as a good substitute for the traditional coagulant CaO.

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