

Valorisation of waste chicken feathers: Optimisation of keratin extraction from waste chicken feathers by sodium bisulphite, sodium dodecyl sulphate and urea

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Abstract:

Extraction of keratin from keratinous waste materials, such as chicken feathers, has been identified as the favourable approach in beneficiation of this biomass. The chemical extractions of keratin by reducing agents are usually preferred because the process is much faster than its counterpart, oxidation extraction. One such reduction extraction is the use of a mixture of sodium bisulphite, sodium dodecyl sulphate and urea. There are at least five factors that may affect the keratin extraction process and its final properties when using this extraction. Even though this extraction method is often used, the effects of its independent variables have not been studied; as a result, the effects of independent variables cannot be fully linked to the extraction process and final keratin properties. Therefore, this study aimed to optimise the extraction of keratin from waste chicken feathers using sodium bisulphite, sodium dodecyl sulphate and urea. The optimisation was statistically performed using Response Surface Methodology (RSM) linked with Box-Behnken Design. After screening the independent variable using one factor at a time method, the concentration of sodium bisulphite, concentration of sodium dodecyl sulphate, reaction temperature and reaction time were chosen for the study. Twenty-nine experiments were statistically designed and executed, and their results were used to analyse the effects of all the independent variables in order to optimise the extraction process. The reaction temperature was found to be the most significant factor, while the concentration of sodium dodecyl sulphate was the most insignificant factor of this extraction process. Independent variables significance order was reaction temperature > reaction time > concentration of NaHSO_3 > concentration of $\text{NaC}_{12}\text{H}_{25}\text{SO}_4$. The designed reduced cubic model was significant and was used to predict the protein yield from the keratin extraction using sodium bisulphite.