

KINETIKA SIFAT FISIK, LAJU PEMBENTUKAN INTI, DAN PERTUMBUHAN KRISTAL PADA PENGOLAHAN GULA SEMUT MENGUNAKAN PAN EVAPORATOR DENGAN PERLAKUAN KAPASITAS NIRA SEGAR DAN PENAMBAHAN EKSTRAK JAHE

INTISARI

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Gula semut merupakan salah satu jenis gula dengan bahan baku nira palem berbentuk butiran (kristal). Pembuatan gula semut saat ini masih dilakukan secara tradisional sehingga produk yang dihasilkan masih belum baik. Salah satu upaya untuk meningkatkan kualitas produk gula semut, perlu dilakukan evaluasi mengenai kinetika proses pembuatannya. Tujuan penelitian ini adalah menentukan kinetika proses pembuatan gula semut menggunakan pan evaporator dan kristalisasi secara manual sehingga dapat meningkatkan dan produktivitasnya serta dapat dimanfaatkan oleh produsen gula semut.

Pembuatan gula semut pada penelitian ini menggunakan nira segar dengan perlakuan kapasitas 3, 6, dan 9 liter serta perlakuan produk akhir. Proses evaporasi dan kristalisasi gula semut dilakukan menggunakan *pan* evaporator. Selama proses ini, diamati laju pembentukan inti dan pertumbuhan kristal serta perubahan sifat fisik berupa suhu, brix, dan densitas nira. Data dianalisis menggunakan kinetika avrami untuk mencari konstanta perubahan suhu selama evaporasi, konstanta perubahan brix dan konstanta perubahan densitas serta kinetika orde 1 untuk mencari nilai konstanta perubahan suhu selama kristalisasi. Analisis data produk akhir yang dilakukan diantaranya ialah distribusi ukuran, rendemen, warna, dan kadar air.

Hasil penelitian menunjukkan nilai konstanta perubahan suhu, brix, dan densitas pada proses evaporasi berturut - turut sebesar 0,21 – 0,39 °C/menit, $3,77 \times 10^{-6}$ – $3,74 \times 10^{-5}$ %/menit, dan $4,53 \times 10^{-6}$ – $8,27 \times 10^{-5}$ kg/m³.menit. Nilai konstanta perubahan suhu dan densitas selama proses kristalisasi berturut - turut sebesar 0,04 – 0,09 °C/menit dan 0,09 – 0,12 kg/m³.menit. nilai konstanta laju pembentukan inti, pertumbuhan kristal, fineness modulus, dan diameter partikel gula semut yang didapat berkisar antara 2,02 – 6,88 jumlah/jam, 0,51– 2,54 mm/jam, 3,99 – 4,91 dan 1,72 – 3,16 mm. Nilai kadar air dan rendemen gula semut yang didapat berkisar antara 1,44 – 2,81 % dan 15,83 – 25,93 %, serta warna gula semut yang didapat kuning kecokelatan.

Kata kunci: nira kelapa, evaporasi, kristalisasi, gula semut, kinetika

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KINETICS OF PHYSICAL PROPERTIES, THE NUCLEATION RATE, AND CRYSTAL GROWTH IN THE PROCESSING PALM SUGAR USING PAN EVAPORATOR WITH CAPACITY TREATMENT OF FRESH COCONUT SAP AND ADDITION OF GINGER EXTRACT

ABSTRACT

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Palm sugar is one type of sugar with palm sap as raw materials in the form of granules (crystals). The making of palm sugar is still done traditionally so that the resulting product is still not good. One of the efforts to improve the quality of palm sugar products, it is necessary to evaluate the kinetics of the manufacturing process. The purpose of this study was to determine the kinetics of the process of making granulated sugar using a pan evaporator and manual crystallization so that it can increase its productivity and can be utilized by producers of granulated sugar.

The production of ant sugar in this study used fresh sap with treatment capacities of 3, 6, and 9 liters as well as treatment of the final product. The process of evaporation and crystallization of palm sugar was carried out using a pan evaporator. During this process, the rate of nucleation and crystal growth was observed as well as changes in physical properties such as temperature, brix, and sap density. The data were analyzed using Avrami kinetics to find the constant of temperature change during evaporation, the constant of change of Brix and the constant of density change, and first-order kinetics to find the value of the constant of temperature change during crystallization. The final product data analysis carried out included size distribution, yield, color, and water content.

The results showed that the constant values of temperature, Brix, and density changes in the evaporation process were $0.21 - 0.39$ °C/minute, $3.77 \times 10^{-6} - 3.74 \times 10^{-5}$ %/minute, and $4.53 \times 10^{-6} - 8.27 \times 10^{-5}$ kg/m³.minute. The constant values for temperature and density changes during the crystallization process were $0.04 - 0.09$ °C/minute and $0.09 - 0.12$ kg/m³.minute. The constant values for the rate of formation of nuclei, crystal growth, fineness modulus, and the diameter of the granulated sugar particles obtained ranged from 2.02 to 6.88 quantities/hour, 0.51 to 2.54 mm/hour, 3.99 to 4.91, and 1.72 to 3.16 mm. The water content and yield of palm sugar obtained ranged from 1.44 – 2.81% and 15.83 – 25.93%, and the color of palm sugar obtained was yellow-brown.

Keywords: crystallization, evaporation, kinetic, palm sugar, sap palm

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