MODEL PERUBAHAN KADAR AIR DAN ANALISIS KUALITAS FISIK DAN KIMIA PADA PENGERINGAN DAUN BELUNTAS (*Pluchea indica* L.) MENGGUNAKAN VARIASI METODE PENGERINGAN

INTISARI

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Daun beluntas merupakan tanaman obat yang memiliki efek farmakologis, seperti, antioksidan, antidiare, antidiabetes, dan antibakteri. Pengeringan merupakan salah satu proses sebelum daun beluntas dikonsumsi. Namun, selama pengeringan kualitas daun beluntas dapat mengalami degradasi. Tujuan utama dari Penelitian ini adalah melakukan pemodelan matematis perubahan kadar air dan mengkaji perubahan kualitas fisik dan kimia dari daun beluntas kering.

Daun beluntas dengan kadar air 83-90% dikeringkan menggunakan 8 metode pengeringan, yaitu pengering tipe efek rumah kaca (ERK), *cabinet dryer* (CD) suhu 40, 50, 60, dan 70℃, serta *freeze dryer* (FD) suhu 35, 45, dan 55℃. Parameter kualitas fisik dan kimia yang diukur berupa kadar air, warna, penyusutan, rasio rehidrasi, mikrostruktur, *bulk density*, total fenolik, dan aktivitas antioksidan. Analisis yang dilakukan, yaitu pemilihan model perubahan kadar air, penentuan nilai difusivitas efektif dan energi aktivasi, uji statistik, dan penentuan metode pengeringan terbaik menggunakan TOPSIS.

Hasil penelitian menunjukkan model Page paling baik dalam memprediksi perubahan kadar air. Nilai konstanta laju pengeringan dan difusivitas efektif menggunakan ERK, CD, dan FD secara berurutan 2,33; 1,28-5,76; 0,016%/jam dan 1,15; 1,35-8,73; 0,31-0,33× $10^{-12} m^2/s$. Energi aktivasi menggunakan CD dan FD adalah 42,80 dan 0,069kJ/mol. Kualitas daun beluntas yang dikeringkan menggunakan ERK, CD, dan FD secara berurutan, yaitu kadar air 8,40; 4,92-10,70; 4,73-6,77%w.b; ΔE 13,74; 10,22-15,56; 6,44-7,45; penyusutan panjang dan lebar 38,31; 29,68-39,85; 35,44-42,47% dan 52,83; 49,59-55,40; 35,97-37,04%; rasio rehidrasi 1,72; 1,67-2,16; 2,03-2,25; *bulk density* 18,80; 18,40-21,00; 16,00-17,77 kg/m^3; total kandungan fenolik 31,55; 30,96-32,17; 31,58-36,44mgGAE/g berat padatan; serta aktivitas antioksidan 37,32; 67,53; 31,18-45,23%. Metode pengeringan yang paling optimal adalah *freeze dryer* suhu 45℃.

Kata kunci: Pengeringan, daun beluntas, *freeze drying*, *cabinet drying*, pengering efek rumah kaca, pemodelan matematis, kualitas fisik dan kimia, difusivitas efektif, energi aktivasi

MODEL OF CHANGES IN WATER CONTENT AND PHYSICAL AND CHEMICAL QUALITY ANALYSIS OF DRYING BELUNTAS LEAF (*Pluchea indica* L.) USING VARIATIONS OF DRYING METHODS

ABSTRACT

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Beluntas leaves are medicinal plants that have pharmacological effects, such as antioxidant, antidiarrheal, antidiabetic, and antibacterial. Drying is one of the processes before the beluntas leaves are consumed. However, during drying the quality of beluntas leaves can be degraded. The main objective of this research is to perform mathematical modeling of changes in water content and to examine changes in the physical and chemical quality of dried beluntas leaves.

Beluntas leaves with a moisture content of 83-90% were dried using 8 drying methods, namely the greenhouse effect dryer (ERK), cabinet dryer (CD) at 40, 50, 60, and 70℃, and freeze dryer (FD) at 35, 45, and 55℃. Physical and chemical quality parameters measured were water content, color, shrinkage, rehydration ratio, microstructure, bulk density, total phenolic, and antioxidant activity. The analysis carried out, namely the selection of a model of changes in water content, determining the value of effective moisture diffusivity and activation energy, statistical tests, and determining the best drying method using TOPSIS.

The results showed that Page's model was the best at predicting changes in water content. The value of drying rate constant and effective moisture diffusivity using ERK, CD, and FD, respectively, is 2,33; 1,28-5,76; 0,016 %/hour and 1,15; 1,35-8,73; 0,31-0,33×10^{-12} m^2/s. The activation energy using CD and FD are 42,80 and 0,069 kJ/mol, respectively. The quality of the dried beluntas leaves using ERK, CD, and FD sequentially, namely the moisture content 8,40; 4,92-10,70; 4,73-6,77%w.b; ΔE 13,74; 10,22-15,56; 6,44-7,45; shrinkage of length and width 38,31; 29,68-39,85; 35,44-42,47% and 52,83; 49,59-55,40; 35,97-37,04%; rehydration ratio 1,72; 1,67-2,16; 2,03-2,25; bulk density 18,80; 18,40-21,00; 16,00-17,77 kg/m3; total phenolic content 31,55; 30,96-32,17; 31,58-36,44 mg GAE g^{-1} dry matter; and antioxidant activity 37,32; 67,53; 31,18-45,23%. The most optimal drying method is freeze dryer at 45℃.

Keywords: Drying, beluntas leaves, freeze drying, cabinet drying, greenhouse effect drying, mathematical modelling, physical and chemical quality, effective diffusivity, activation energy