ISOLASI GLUKOMANAN DARI TEPUNG PORANG (*Amorphophallus muelleri* Blume) DENGAN PERLAKUAN AWAL *FREEZE-THAW CYCLE* DAN METODE EKSTRAKSI *AQUEOUS TWO-PHASE SYSTEM* (ATPS) SERTA PENGARUHNYA TERHADAP KARAKTERISTIK GLUKOMANAN

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INTISARI

Glukomanan merupakan hidrokoloid yang banyak terkandung dalam umbi porang (*Amorphophallus muelleri* Blume). Komponen utama dalam umbi porang adalah glukomanan, dan komponen lain berupa protein, pati dan senyawa oksalat. Metode isolasi glukomanan menggunakan ekstraksi padat-cair dengan pelarut etanol atau isopropil alkohol 40–80% dengan perbandingan bahan:pelarut (1:15) pada suhu 50–80 °C. Metode ini menghasilkan glukomanan yang belum memenuhi standar global karena glukomanan dan komponen lainnya belum terpisah optimal. Dalam penelitian ini, isolasi glukomanan dari tepung porang dilakukan menggunakan 3 metode yang berbeda yaitu dengan perlakuan awal *freeze-thaw cycle* (FTC), metode ekstraksi *Aqueous Two-phase System* (ATPS) dan metode ekstraksi dengan pelarut etanol sebagai pembanding.

Perlakuan awal FTC dilakukan dengan *freezing* pada suhu -20 °C (*slow freezing*) dan *thawing* di suhu 4 °C. Perlakuan awal FTC meliputi 3 jenis waktu *freezing* 2, 4, dan 6 hari dan 4 siklus yaitu 1, 2, 3, dan 4. *Freeze-thaw cycle* dapat merusak jaringan umbi porang sehingga dapat memudahkan pemisahan glukomanan dan komponen lain (pati, protein, oksalat). Optimasi perlakuan awal FTC dilakukan dengan metode *response surface method* (RSM) dan pemodelan *generalized linear model* (GLM) dengan variabel bebas adalah waktu *freezing* dan jumlah siklus, sedangkan parameter respon yang diamati adalah yaitu kadar glukomanan, oksalat dan pati. Metode ekstraksi *Aqueous Two-Phase System* (ATPS) menggunakan campuran garam-etanol. Garam yang digunakan adalah Na_2HPO_4 dan K_2HPO_4 dengan 3 konsentrasi berbeda (1, 2, dan 3%) yang memiliki efek *salting out* dalam peningkatan kepolaran fase air dan fase etanol sehingga pemisahan glukomanan dan komponen lain (pati, protein, senyawa karotenoid) menjadi optimal. Ekstraksi menggunakan etanol 40% digunakan sebagai metode pembanding kedua metode ekstraksi FTC dan ATPS. Glukomanan hasil isolasi dari masing-masing metode dilakukan karakterisasi komposisi kimia, sifat fisika, termal, struktur kimia dan morfologi.

Glukomanan hasil isolasi dengan pelarut etanol (metode pembanding) menghasilan kadar >75% dan bahan lain yaitu protein ≤1,5%, kadar pati ≤1,5%, kadar abu ≤1,5%, dan Pb ≤1%. Perlakuan awal FTC menghasilkan glukomanan dengan kadar >75%, kadar abu <1,5%, Pb ≤1% namun kadar protein dan pati bervariasi. Pemenuhan komponen pengotor dapat dilakukan berdasarkan persamaan optimasi perlakuan awal FTC untuk tiap komponen dan glukomanan yang diperoleh menurun tingkat kecerahannya, viskositas dan serta perubahan

granula glukomanan menjadi lebih kasar. Glukomanan yang diisolasi dari metode ATPS memiliki kadar glukomanan >75% dan penurunan kadar protein <0,5%, derajat warna putih dan stabilitas termal yang lebih tinggi dibandingkan glukomanan metode pembanding. Ketiga metode isolasi menghasilkan glukomanan sesuai standar *European Food Safety Authority* (EFSA) dan FAO. Perbedaan metode isolasi berpengaruh terhadap karakteristik morfologi glukomanan yang bermanfaat dalam aplikasi di bidang farmasi, pangan, kosmetik dan lainnya.

ISOLATION OF GLUCOMANNAN FROM PORANG FLOUR (*Amorphophallus muelleri* Blume) WITH FREEZE-THAW CYCLE PRE-TREATMENT AND AQUEOUS TWO-PHASE SYSTEM (ATPS) EXTRACTION METHOD AND ITS EFFECT ON GLUCOMANNAN CHARACTERISTICS

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ABSTRACT

Glucomannan is a hydrocolloid that is abundant in porang tubers (*Amorphophallus muelleri* Blume). The main component in porang tubers is glucomannan, and other components are protein, starch and oxalate compounds. The glucomannan isolation method uses solid-liquid extraction with ethanol or isopropyl alcohol solvents 40–80% (w/w) with a ratio of material:solvent (1:15) at a temperature of 50–80 °C. This method produces glucomannan that does not fulfill global standards because the glucomannan and the other components are not separated optimally. On the other hand, this extraction method produces alcohol as a by-product in large quantities. In this study, the isolation of glucomannan from porang flour was carried out using 3 different methods, namely with the freeze-thaw cycle (FTC) pre-treatment, the Aqueous Two-phase System (ATPS) extraction method and the extraction with ethanol solvent as a comparison method.

The FTC pre-treatment method was carried out by freezing at -20 °C (slow freezing) and thawing at 4 °C. The FTC pre-treatment included 3 types of freezing time: 2, 4, and 6 days and 4 cycles: 1, 2, 3 and 4. The freezing-thawing cycles could break the tissue of Porang tubers and facilitate the separation of glucomannan and the other components. Optimization of FTC pre-treatment was carried out using the response surface method (RSM) and generalized linear model (GLM), where the independent variables were freezing time and number of cycles, while the observed response parameters were glucomannan, oxalate, and starch levels. The Aqueous Two-phase System (ATPS) extraction method was composed of salt-ethanol as a solvent. The salts used were Na_2HPO_4 and K_2HPO_4 with 3 different concentrations (1, 2, and 3%). The salt affected the salting out in the ATPS, increased the polarity of the aqueous phase and the nonpolarity of the ethanol phase, and optimized the separation of glucomannan and the other components. The extraction using 40% of ethanol was defined as the comparison method. The isolated glucomannan from each method was characterized for chemical composition, physical properties, functional, thermal, chemical structure and morphology.

The glucomannan isolated with ethanol solvent (comparative method) produced a content of >75% and other ingredients, namely protein ≤1.5%, starch content ≤1.5%, ash content ≤1.5%, and Pb ≤1%. The FTC pre-treatment produced glucomannan with a content of >75%, ash content <1.5%, Pb ≤1%, but the protein and starch content varied. The fulfillment of impurity components could be done

based on the FTC pre-treatment optimisation equation for each component and the glucomannan obtained decrease in brightness, viscosity, and changes in glucomannan granules to become rough. The isolated glucomannan with the ATPS method had a glucomannan content of >75% and a decrease in protein content of <0.5%, a higher degree of whiteness index, and thermal stability compared to glucomannan from the ethanol method. All the isolation methods produced glucomannan that meets the requirements of the European Food Safety Authority (EFSA) and FAO standards. The differences in isolation methods affected the morphological characteristics of glucomannan, which are useful in applications in the pharmaceutical, food, cosmetic, and other fields.