

## INTISARI

Cangkang kapsul keras umumnya dibuat dari gelatin hewani yang memiliki keterbatasan seperti isu kehalalan dan keamanan. Oleh karena itu, diperlukan alternatif bahan pembuat yang bersumber dari bahan alam lokal. Salah satu bahan yang berpotensi adalah pati garut (*Maranta arundinacea* L.) yang mengandung amilopektin tinggi. Penelitian ini dilakukan untuk memformulasikan dan mengoptimasi cangkang kapsul keras berbasis pati garut dengan penambahan gliserin sebagai *plasticizer* untuk memperoleh karakteristik fisik dan mekanik yang sesuai standar.

Penelitian dilakukan secara eksperimental di laboratorium menggunakan metode *Simplex Lattice Design* (SLD) pada perangkat lunak *Design-Expert* 13.0 untuk menentukan proporsi optimum antara pati garut dan gliserin. Konsentrasi pati garut ditetapkan pada rentang 6–10%, sedangkan gliserin pada rentang 5–9%. Evaluasi sediaan meliputi uji organoleptis (bentuk, warna, bau, dan tekstur), spesifikasi fisik (panjang, diameter, ketebalan, volume, bobot), uji *swelling*, uji kuat tarik, dan uji waktu hancur dalam larutan asam. Data dianalisis menggunakan *Design-Expert* 13.0 untuk menentukan formula optimum dan nilai *desirability* tertinggi, kemudian dikonfirmasi secara statistik dengan *one-sample t-test* pada tingkat kepercayaan 95%.

Hasil optimasi menunjukkan formula optimum diperoleh pada konsentrasi pati garut 10% dan gliserin 5% dengan nilai *desirability* 0,891. Formula optimum menunjukkan karakteristik organoleptis berbentuk silindris, berwarna putih keruh pucat, tidak berbau, dan bertekstur kaku, serta memiliki panjang badan  $19,80 \pm 0,60$  mm dan tutup  $12,48 \pm 0,40$  mm; diameter badan  $7,99 \pm 0,40$  mm dan tutup  $7,99 \pm 0,14$  mm; volume  $0,65 \pm 0,04$  mL; ketebalan  $0,33 \pm 0,03$  mm; bobot  $134,87$  mg; *swelling*  $180,66 \pm 2,76$  %; dan waktu hancur dalam larutan asam  $779,00 \pm 18,08$  detik. Hasil pengujian eksperimental formula optimum tidak berbeda signifikan dibandingkan nilai prediksi pada parameter ketebalan, *swelling*, dan waktu hancur dalam larutan asam. Dengan demikian, pati garut berpotensi dikembangkan sebagai bahan alternatif cangkang kapsul keras non-gelatin.

**Kata Kunci:** Cangkang kapsul keras, pati garut, gliserin, *plasticizer*, optimasi

## **ABSTRACT**

*Hard capsule shells are commonly produced from animal-derived gelatin, which has limitations related to halal issues and safety concerns. Therefore, alternative materials derived from local natural resources are needed. One potential material is arrowroot starch (*Maranta arundinacea* L.), which contains a high amylopectin content and has the ability to form a film matrix. This study aimed to formulate and optimize hard capsule shells based on arrowroot starch with the addition of glycerin as a plasticizer to obtain physical and mechanical characteristics that meet standard requirements.*

*The study was conducted experimentally in the laboratory using the Simplex Lattice Design (SLD) method with Design-Expert 13.0 software to determine the optimum proportion of arrowroot starch and glycerin. The concentration of arrowroot starch was set at 6–10%, while glycerin was set at 5–9%. The prepared capsule shells were evaluated through organoleptic tests (shape, color, odor, and texture), physical specifications (length, diameter, thickness, volume, and weight), swelling test, tensile strength, and disintegration time in acidic solution. The experimental data were analyzed using Design-Expert 13.0 to determine the optimum formulation with the highest desirability value, followed by statistical confirmation using a one-sample t-test at a 95% confidence level.*

*The optimization results showed that the optimum formulation consisted of 10% arrowroot starch and 5% glycerin, with a desirability value of 0.891. The optimum capsule shells exhibited cylindrical shape, pale cloudy white color, odorless properties, and a rigid texture, with a body length of  $19.80 \pm 0.60$  mm and cap length of  $12.48 \pm 0.40$  mm; body diameter of  $7.99 \pm 0.40$  mm and cap diameter of  $7.99 \pm 0.14$  mm; volume of  $0.65 \pm 0.04$  mL; thickness of  $0.33 \pm 0.03$  mm; weight of 134.87 mg; swelling of  $180.66 \pm 2.76\%$ ; and disintegration time in acidic solution of  $779.00 \pm 18.08$  s. The experimental results of the optimum formulation showed no significant differences compared to the predicted values for thickness, swelling, and disintegration time. Therefore, arrowroot starch has strong potential to be developed as a non-gelatin alternative material for hard capsule shells.*

**Keywords:** *Hard capsule shell, arrowroot starch, glycerin, plasticizer, optimization*