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Research Article

THE SPERMICIDE GELS FORMULATION FROM THE DURIAN'S (*DURIO ZIBETHINUS* MURR.) CORTEX EXTRACT: THE DECOLOURIZATION AND SOLID DISPERSION

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ABSTRACT

Objective: The efficacy of the *Durio zibethinus* cortex extract as spermicidal agent was investigated on mice sperms and human sperms. The intense color spoiled the final product appearance. The purpose of this study was to determine the effect of decolorization and the best formula for preparation the spermicide gel from *D. zibethinus* cortex extract.

Methods: The extract of the *D. zibethinus* cortex was prepared by two-step methods before made into the spermicide gels preparation. First, decolorization used activated carbon and second, the extract was formed into solid dispersion with variation of the polyethylene glycol (PEG) 6000 concentration were 2%, 4%, 6%, and 10%. The extract quality was investigated by total phenolic. The gel preparation was evaluated for pH value, viscosity, and spreadability.

Results: The decolorization reduced 23.25% of total phenolic. The variation of the PEG 6000 concentration increased the viscosity ($p<0.05$) but decreased pH value and the spreadability ($p<0.05$).

Conclusion: The decolorization increased final product appearance and formulation with 2% of PEG 6000 was found to be the best.

Keywords: Spermicide gels, *Durio zibethinus*, Decolorization, Solid dispersion.

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INTRODUCTION

Spermicides are a biologically obvious way to immobilize or kill the sperm upon contact [1]. An ideal spermicide should immediately and irreversibly produce immobilization of the sperm, nonirritating to the vaginal and penile mucosa, not have adverse effects on the developing fetus, free from long-term topical and systemic toxicity and should not be systemically absorbed [2]. The *Durio zibethinus* Murr. cortex extract has been used as traditional contraceptive in South Borneo. The efficacy of the *D. zibethinus* cortex extract was investigated on mice sperms and human sperms [3].

The challenges of developing formulation from plants are the intense color of the extract and must be easy to use. Hence, we design the spermicide gels formulation with two-step methods. We decolorized the extract and formed into solid dispersion.

MATERIALS AND METHODS

Materials

D. zibethinus cortex was provided from Banjar District in South Borneo, ethanol 96% (Mulya Jaya); glycerin (Brataco); hydroxypropyl methylcellulose (HPMC) K100M (Honest); methylparaben, propylparaben, and propylene glycol (CV. Agung Menara Abadi); and polyethylene glycol (PEG) 6000 (Asia Chemical Co.).

Methods

Decolorization used active carbon

The activated carbon was inserted to the raw extract of the *D. zibethinus* cortex. The ratio of the raw extract and powdered activated carbon was 1:0.001 with contact period was 10 second. After the treatment, the treated extracts and non-treated extract were measured their total phenolics.

Total phenolic assay

An aliquot (0.5 ml) of the extract was added to volumetric flask containing 0.75 ml of Folin-Ciocalteu reagent and then shaken. After 5 minutes, 2 ml of 2% Na_2CO_3 solutions was added to the mixture. After incubation for 15 minutes at room temperature, the absorbance was determined with an ultraviolet-visible spectrophotometer [4].

Preparation of solid dispersion extract

Solid dispersion of the *D. zibethinus* cortex extract was prepared with variation of the PEG 6000 concentration were 2%, 4%, 6%, and 10%. Each formula was mixed with ethanol 96% as solvent and then the mixture was dried at temperature 45°C and sieved [5].

Formulation of the spermicide gels

The details compositions of the spermicide gels formulation are shown in Table 1.

First, an HPMC was dissolved in aqua at temperature 80°C than stirred slowly for 10 minutes. Second, methylparaben, propylparaben, propylene glycol, glycerin, and the solid dispersion extract were added to the mixture of HPMC and aqua.

Evaluation of the spermicide gels preparation

Determination of pH value

Accurately 2.5 g of gel was weighed and dispersed in 25 ml purified water. The pH value was measured using pH meter [6]. Standard of pH value for mucosa was around 4.5-6.5 [7].

Determination of viscosity

Viscosity of the gels was determined using a Brookfield viscometer at room temperature with selected the rate of shear [8]. All the formulated

gels were sheared at 12 rpm. Standard of viscosity was around 2000-4000 cPs [9].

Determination of spreadability

Sample was applied in between two glass slides and was compressed to uniform thickness by placing 125 g weight for 1 minute. Spreadibility was known from the calculation of diameter of sample. [10]. Standard of spreadability of gel is around 5-7 cm [11].

RESULTS AND DISCUSSION

The decolorized effect

One of the challenges of using the plant parts in formulation is the dark color of the extract. Decolorization is one of the approaches that can be applied to remove unwanted colors. Activated carbon is the most commonly used of dye and odor removal by adsorption. The decolorized effect on the *D. zibethinus* cortex extract is illustrated in Fig. 1.

We can clearly see the effect of the decolorization by using activated carbon. The differences of color showed that the decolorization can eliminate the intense color of the extract. Activated carbon adsorbed the dark-colored compound [12]. The result of the current study agrees with another study that powdered activated carbon is more suitable for color adsorption [13].

The result of the total phenolic assay

Activated carbon also absorbs some amount of phenolic. Total phenolic assay is very important to achieve desired decolorization effect without significant loss of phenolic. The optimal process parameters for activated treatment are needed. The results of total phenolic in the *D. zibethinus* cortex extract are presented in Table 2.

The analysis of total phenolic showed decreased total phenolic. Hence, 0.001 g of activated carbon could reduce 23.25% of total phenolic.

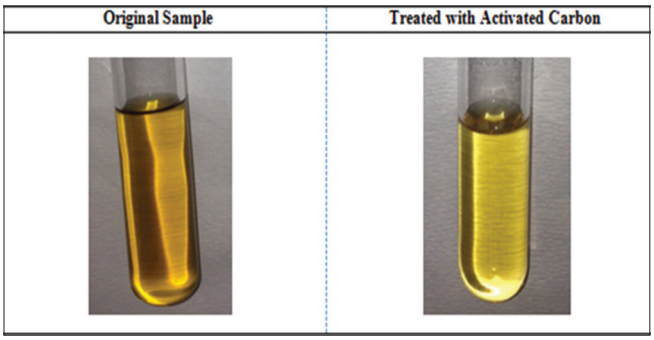

Fig. 1: The decolorized effect on the *Durio zibethinus* cortex extract

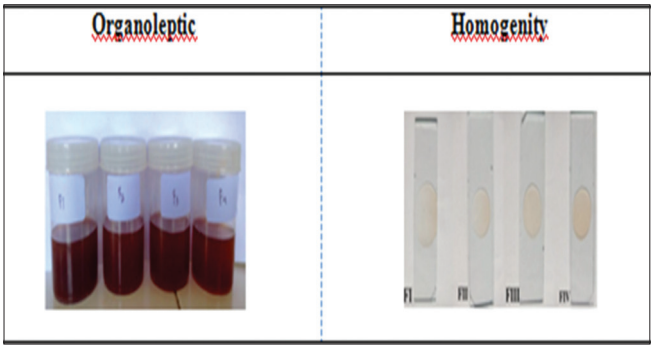

Fig. 2: The spermicide gel preparation on each formula

The spermicide gels preparation

The spermicide gels prepared were found to be brown, translucent, and homogeneous for each formula (Fig. 2).

The design of this preparation with decolorized and solid dispersion increased appearance of the gels preparation.

Evaluation of the spermicide gels preparation

All the prepared gels were subjected to evaluation for pH value, viscosity, and spreadability. The result of evaluation is presented in Table 3.

pH value

The pH value of the spermicide gels was decreased with the increase of the PEG 6000 concentration in the formulation ($p<0.05$). The decrease of pH value might be indicating formation of acidic degradation. Higher concentration of PEG has less dissolved oxygen. Excluding oxygen slows the formation of acids. Hence, the increase of the PEG 6000 would decrease pH value. However, the spermicide gels had suitable pH for skin pH and would not produce skin irritation.

Viscosity

The viscosity of the spermicide gels was increased with the increased of the PEG 6000 concentration ($p<0.05$). The increase of the PEG 6000 would increase viscosity [14]. These polymers cause modification of the process of micellar association, increase entanglement of adjacent molecules with more extensive intermolecular hydrogen bonding [15]. The spermicide gels had suitable viscosity for gels preparation.

Spreadability

The spreadability of the spermicide gels was decreased with the increase of the PEG 6000 concentration ($p<0.05$). The viscosity may be the cause of decreased in spreadability [16]. The cohesive forces made

Table 1: Composition of the spermicide gels formulation

Materials	Formulas			
	F1	F2	F3	F4
Solid dispersion				
Extract	2	2	2	2
PEG 6000	2	4	6	10
HPMC K100M	2	2	2	2
Methylparaben	0.2	0.2	0.2	0.2
Propylparaben	0.05	0.05	0.05	0.05
Glycerin	12	12	12	12
Propylene glycol	10	10	10	10
Aqua Dest ad	100	100	100	100

Table 2: Content of total phenolics in the *D. zibethinus* cortex extract

Materials	Total phenolics (g/1 g fresh mass)
Extract (non-decolorized)	0.0043
Extract (decolorized)	0.0033
Prosentase decreased	23.25%

D. zibethinus: Durio zibethinus

Table 3: Physical characteristic of the spermicide gels formulation

Formulas	pH	Viscosity	Spreadability
F1	5.36±0.002	2744±19.245	7.07±0.058
F2	5.33±0.010	2867±33.333	6.78±0.058
F3	5.25±0.002	3322±9.623	6.47±0.058
F4	5.20±0.002	3411±19.245	6.07±0.115

the larger interaction between molecules and caused the preparation would be difficult to spread.

CONCLUSION

The decolorization increased final product appearance and formulation with 2% of PEG 6000 were found to be the best. The *D. zibethinus* cortex extract can be an alternative compound for future use as safe spermicide.

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