

CHARACTERISATION, CREAM AND SOAP PRODUCTION USING FENUGREEK SEEDS OIL

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ABSTRACT

Trigonella foenumgraecum commonly known as Fenugreek is an aromatic herb used as a medicinal plant in the therapeutic management of human diseases. Use of chemically oriented skin creams and soaps can produce harmful effects. Hence, this research was conducted to extract oil from fenugreek seeds, characterize the oil then formulate body cream and soap. The oil was extracted from Fenugreek seed using soxhlet extraction method with n-hexane as the extraction solvent. Cream was prepared as semi-solid **Water- in- oil (W/O) emulsion method by the addition of aqueous phase to the oily phase with continuous agitation**. Physico-chemical and phytochemical analysis of the oil were carried out using standard protocol. The percentage yield of the oil was 5.83 ± 0.5 % (w/w). The oil at room temperature indicated yellow colour, a refractive index of 1.479, acid value of 6.413 mg/g oil, iodine value (148.564 g/100 g of oil). High saponification value (190.277mg KOH/g of oil) indicated a high content of low molecular weight triacylglycerols in the oil. The phytochemical parameters, revealed the presence of Alkaloids, Flavonoids and Terpenoids in high amount while Saponins, Steroids and Tannins were in traces amount, while Phenol was not detected. Soap was prepared using the extracted oil and cornstalk ash using the semi boiling processes which followed major steps of saponification, fitting, molding and drying. The physicochemical characteristics of the soap were determined. Body cream was also successfully prepared as semi-solid water- in- oil (W/O) emulsion by the addition of aqueous phase to the oily phase with continuous agitation. Both cream base and fenugreek oil extract loaded cream were successfully prepared without any phase separation. The appearance of the cream was good and the distribution of the extracts in the cream were uniform in the medium. The fenugreek cream and soap are recommended for use due to the phytochemical properties portrayed in this study as well as the ease of lather formation of the soap and the non-greasy form of the cream which can be easily washed off the body with water.

Keywords: Cream, Fenugreek, Physico-chemical parameters, Phytochemical, Saponification,

INTRODUCTION

Plants are organisms of the biological kingdom Plantae, categorised as photosynthetic and having a rigid cell wall. *Trigonella foenumgraecum* (fenugreek) commonly called Fenugreek is an aromatic herb belonging to the family Fabaceae, that has been used as a spice throughout the world to improve the sensory quality of foods (Serrano *et al.*, 2013). The plant seeds contains active constituents such as alkaloids, flavonoids, steroids, Saponins which have been shown to be toxic to

bacteria, parasites and fungi. Fenugreek is known to have antidiabetic, anticarcinogenic, hypocholesterolemic, antioxidant, and immunological activities. Modern research has recognized fenugreek as a valuable medicinal plant with potential for curing diseases and also as a source for preparing raw materials of pharmaceutical industry. Use of fenugreek has been found to be lethal against hazardous bacteria, specifically coli forms *Pseudomonas spp*, *Shigella dysenteriae* and *Salmonella typhi*. The potential uses of in vitro propagated

plants as sources for new drugs are still largely unexplored (Clement *et al.*, 2010). The presence of phytochemical constituents in medicinal plants make them useful for healing of human diseases (Yahaya *et al.*, 2017). Phytochemicals are naturally occurring compounds in the medicinal plants (Wadood *et al.*, 2013). Skin care preparations are designed to exert activity when applied on the skin. The preparations include creams, lotions and ointments and are used in the treatment of burns, wound, bacterial and superficial fungal infections. Considering the concentration of drug and the degree of solubility, topical formulations are said to be beneficial for treating localized skin infection (Woodruff, 2015). In an emulsion the therapeutic properties and spreading ability of the constituents are increased. Water-in-oil emulsions are employed more widely for the treatment of dry skin and emollient applications (Yahaya *et al.*, 2017). Formulated emulsion can act as a vehicle for delivering drugs to the body as it has been found to have several advantageous characteristics. Additional value can be given to these formulations by including plant extracts with specific cosmetic effects (Clemente *et al.*, 2010).

Oils had made an important contribution to the diet of people in many countries, serving as a good source of protein, lipid and fatty acids for human nutrition including the repair of worn out tissues, new cells formation as well as a useful source of energy. In Nigeria, Fenugreek seed oil is considered as one among newer sources of edible oils. These oils are used mainly as cooking oils and for the production of soap, margarine, and cosmetics (Irvine 2014). Oil quality and its stability are therefore very important for the consumers and in applications to industries (Debrah and Waliyer, 2006). The exposure to the sunlight radiation may give adverse effect to the skin colour (Stanojevic, 2014). Other effects of weather conditions include rashes and pimples on oily skin. Use of chemically oriented skin creams and soaps can produce harmful effects. Therefore, this is the main reason why this research was conducted to

extract oil from fenugreek seeds, characterize the oil then formulate body cream and soap using the fenugreek seed oil.

METHODOLOGY

Sample Collection

The seeds of *T. foenum-graecum* was purchased in Birnin Kebbi, Central Market, Kebbi State Nigeria. The sample was identified and authenticated at the herbarium of Kebbi State University Alero (voucher number KSUSTA/DPSB/VN/30). The sample was transported to the Department of Science Laboratory Technology of Waziri Umaru Federal Polytechnic Birnin Kebbi and stored in Microbiology Laboratory for examination.

Sample Preparation

The seeds were dried in the shade for two weeks and then in an electric oven at 40°C until a constant weight were reached. The seeds were ground in an electric mill to a fine powder, packaged, and stored in a refrigerator at 4°C prior to the analysis.

Extraction *T. foenum-graecum* Seed Oils

The oil from the powdered seeds was extracted using N-hexane as the solvent in a soxhlet apparatus for about 6 hours. The solvent was removed by rotary vacuum evaporation. The percentage of the recovered oil content was computed as percentage of total oil present in seed (Clemente *et al.*, 2010).

PHYSICO-CHEMICAL AND PHYTOCHEMICAL

CHARACTERISTICS ANALYSIS

Determination of Percentage (%) Yield of Oil

The Percentage yield of *T. foenum-graecum* oils was calculated using the standard formula (Clement *et al.*, 2010). Other chemical characteristics determined include: Iodine test value, saponification value test, peroxide test value and free fatty acid test. While the physical characteristics determined included colour, odour, homogeneity and texture.

PHYTOCHEMICAL ANALYSIS

Phytochemical screening was done according to Mibei *et al.* (2012) and

Akinyemi *et al.* (2015) as follows: 2ml of Wagner's reagent was added to 2ml of seed extracts; the formation of a reddish brown precipitate indicated the presence of alkaloids. Five millilitres of dilute ammonia solution was added to 2 ml of the aqueous filtrate of seed extract followed by addition of concentrated H_2SO_4 . A yellow coloration indicated the presence of flavonoids. Tannin was determined by the Folin-Denis colorimetric method described by Akinyemi *et al.* (2015). Test for Phenols was done by diluting the seed extract with 5ml distilled water and then addition of neutral 5% Ferric chloride solution, a blue-black color indicated the presence of phenolic compounds. Saponins presence was indicated by the formation of a stable froth after addition of distilled water to boiled seed powder with vigorous shaking. **For Terpenoids test**, seed extract was mixed with 2ml of chloroform and concentrated H_2SO_4 , the formation of a reddish brown coloration at the interface indicated presence of Terpenoids (Mibei *et al.*, 2012).

PREPARATION OF CREAM

Semi-solid Water- in- oil (W/O) emulsion was prepared by the addition of aqueous phase to the oily phase with continuous agitation. To prepare the base, an oily phase that consisted of paraffin oil (16%) and surfactant ABIL-EM 90 (3.5%) was heated up to $75 \pm 1^\circ C$. At the same time, aqueous phase consisting of

distilled water was heated to the same temperature. After heating, aqueous phase was added to the oily phase drop by drop. Stirring was continued at 2000 rpm by the mechanical mixer for 15min until complete aqueous phase was added, 2 to 3 drops of lemon oil were added during this stirring time to give good fragrance to the emulsion. After the complete addition of the aqueous phase, the speed of the mixer was reduced to 1000 rpm for homogenization, for about 5min, and then the speed of the mixer was reduced to 500rpm for another 5min to enable homogenization. The formulation was cooled to room temperature and poured into sterile containers (Bhide, and Sachin, 2009).

PREPARATION OF SOAP

The soap making process involved semi boiling processes which followed major steps of saponification, fitting, molding and drying (AOAC, 2013). Boiling involved reacting the oil with caustic alkali in open steam to obtain a finished soap. The effectiveness of the reaction is temperature dependent. Semi-boiling involved melting of oil to a relative temperature while a weak solution of caustic soda was added in small amount at regular intervals until saponification became complete. The prepared soap was allowed to cool and then poured in molds to form the desired shape. The soap was then allowed to dry. The soap made does not strip people's skin off their natural oils while the glycerol is retained.

RESULTS

Table 1 physicochemical parameter of the extracted fenugreek oil

S/N	PHYSICOCHEMICAL	RESULT ¹
1.	Refractive index	1.479 ± 0.233
2.	Iodine value	148.564 ± 2.025 g/100
3.	Acid value	6.413 ± 0.196 mg/g
4.	Saponification value	190.277 ± 2.391 mg KOH/g
5.	Peroxide value	0.627 ± 0.033
6.	Fatty acid value	56.4 meq/kg
7.	Texture	Smooth
8.	Odour	Pleasant
9.	Colour	Warm yellow

Value represents mean $\pm$ standard deviation
The fenugreek oil exhibited a smooth texture, warm yellow colour and a pleasant

odour. The Refractive index was 1.479 ± 0.233 , Iodine value was 148.564 ± 2.025

g/100, Acid value was 6.413 ± 0.196 mg/g, Saponification value was found to be 190.277 ± 2.391 mg KOH/g, Peroxide

value of 0.627 ± 0.033 while the Fatty acid value was 56.4 meq/kg.

Table 2: Phytochemical composition of fenugreek seed extract

S/N	PHYTOCHEMICAL TEST	RESULT
1.	Alkaloids	+++
2.	Flavonoids	+++
3.	Saponins	+
4.	Tannins	+
5.	Steroids	++
6.	Terpernoids	+++
7.	Phenol	-

Key:

+++ = Present in high concentration ++ = Present in moderate concentration

+ = Present in trace amount, - = Not detected

Alkaloids, Flavonoids and Terpernoids were found in high concentration while Saponins, Steroids and Tannins were in traces amount,

DISCUSSION

The physicochemical characteristics of fenugreek seed oil as shown in table 1: At room temperature, the oil was yellow with a refractive index of 1.479, which is similar to soybean oil (1.477) and corn oil (1.473) (Liu *et al.*, 2017). The percentage yield of the oil was 5.83 ± 0.5 % (w/w) which is similar to the report of Saraswat, (2014). The acid value of the oil was 6.413 mg/g oil. The high iodine value (148.564 g/100 g of oil) may be due to low content of saturated fatty acid. Fatty acid content of the oil extracted was (56.4 meq/kg) which is rich in unsaturated fatty acids (UFA) (oleic acid, linoleic acid, and linolenic acid making up from 83.19% to 83.33% of total fatty acids) and low in saturated fatty acids (SFA) (primarily palmitic acid, making up from 9.94% to 10.00% of total fatty acids). A similar result was also reported by Clemente *et al.* (2010). The high saponification value (190.277mg KOH/g of oil) of the oil indicated a high content of low molecular weight triacylglycerols in the oil. These results were in agreement with previous research (Nehdi *et al.*, 2017). The peroxide value of the oil was (0.627 meq. O₂/kg oil), the value was relatively lower because the oxidization could be avoided during the course of Spent

Bleaching Earth (SBE) (Wang *et al.*, 2018). This value was higher than that of virgin olive oil (14.600 mg·100 g⁻¹) as indicated by (Koprivnjak *et al.*, 2018). Therefore, these physicochemical characteristics demonstrated that the oil extracted in the present study was an excellent candidate for use as functional edible oil. The phytochemical screening as presented in Table 2: Revealed the presence of Terpernoids, Flavonoids and Alkaloids in high amount. Tannins and Saponins were in trace amount, Steriods was in moderate amount and Phenol was not detected. This result was in line with the study by Serrano *et al.* (2019), on fenugreek seed, leaves and bark. In another study on phytochemical screening of fenugreek seed extract conducted by Igbiosa, *et al.*, (2009) in Edo State, similar results were reported. These phytochemicals are biologically active and can be responsible for the antimicrobial activity of the plant. The mechanisms through which these secondary metabolites exert their antimicrobial activities differ. Tannins have been reported to form irreversible complexes with proline rich protein, thereby inhibiting cell protein synthesis (Serrano *et al.*, 2019). Intestinal disorders such as diarrhoea and dysentery have been treated with herbs that have

tannins as their main components (Havsteen, 2013). Another secondary metabolite observed in the leave extract of fenugreek seed was alkaloid. Alkaloids have analgesic effects and have been clinically used (Sutradhar *et al.*, 2007). Alkaloids have been acclaimed for their antimicrobial activities, especially against gram negative bacteria (Cushnie *et al.*, 2014). Other secondary metabolites present in fenugreek seed extract whose antimicrobial activities have been documented are flavonoids and saponins (Hodek *et al.*, 2012).

Both cream base and fenugreek oil extract loaded cream were successfully prepared without any phase separation as documented by Chauhan and Gupta (2020) on cream preparation. The formulation was homogeneous with the light yellow colour with a good appearance. The prepared cream was water- in- oil (W/O) type emulsion hence can be easily washed with plain water which gives better amenableness; this was comparable with the study by Bhide and Sachin, (2015) on formulation of herbal cosmetics with O/W emulsion. The fenugreek seed soap produced using the extracted oil and soda ash (lye) from millet stalk appeared light brown in colour with a good saponification value. The results showed that fenugreek oil and its products are of diverse pharmacological spectrum which could be of medicinal importance which is the same idea as portrayed by Yasmeen and Shashikumar (2019).

CONCLUSION

Sufficient oil was extracted from Fenugreek seeds which enabled cream and soap formulation. The percentage yield of the oil on extraction was 5.83 ± 0.5 % (w/w). The extracted oil has a pleasant scent with a yellowish colour. The phytochemical results indicate that the plant has high amount of secondary metabolites which can be used for treatment of different types of infections caused by pathogenic microbes. The physio-chemical results reveals that the extracted oil can be used for human consumption. While the cream and soap can

be used to moisturize the skin and also possibly in the treatment of burns, wound, bacterial and superficial fungal infections.

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