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Determination of Physico-Chemical Properties of *Z-spina-christi* (Nabag) Seed Crude Oil

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Abstract

This study was conducted to determine the physical and chemical properties of Nabag seed crude oil .The proximate composition of seed of *Zizyphus spina-christi* fruit were moisture content (4.59%), oil content (28.96%), protein content (16.03%), crude fiber (9.57%) ,ash content (4.47%), and total carbohydrate (36.38%). The physical properties of *Z. spina –Christi* seed oil were refractive index (1.4670), the density (0.9339), the viscosity(33.26 cp), and the colour (1.16 R,20(Y).While the chemical properties were the peroxide value (0.5), the acid value (1.19) , the iodine value (117.38) ,and saponification value (181.39). The main unsaturated fatty acids were oleic acid (57%), and linoleic (22%), while the major saturated fatty acids plamitic acid (7.2%) ,stearic acid (4.7%) and arachidic acid (6.7%).

Key words: Nabag, Sidr

Introduction

Forests. Forest trees play an essential role in the carbon cycle and provide essential environmental and social values and services, beyond their contribution as a source of wood, such as biodiversity conservation; protection against erosion; watershed play a crucial role in the world's environment, health and economy protection and employment in often fragile rural areas. The forest sector has therefore a key role to play in the transition towards a greener and more sustainable economy and forestry lies

at the heart of this "green" movement. Almost every part of the tree; roots, trunk, bark, leaves, flowers, fruits and seeds, is known to have some uses. They could also contribute to the supply of nutrients to the soil via nitrogen fixation as leguminous does (Bello and Abdu, 2011).

About 80% of the world population relies on the use of traditional medicine, which is predominantly based on plant material (WHO, 1993). Scientific studies available on a good number of medicinal plants indicate that promising phytochemicals can be developed for many health problems (Dahiru *et al*., 2005). A number of important wild edible fruits have been identified among them is *Zizyphus spina-christi* which has served as a source of food and medicine for thousands of years (Baytop, 1984; Gultekin, 2007). It has been reported to possess unique nutritional and organoleptic characteristics (Akbolat *et al*., 2008). *Zizyphus spina-christi* (L), locally known as sidr, is a multipurpose tree species belonging to the botanical family Rhamnaceae (Abeer and Reem, 2009). *Z. spina-christi* is a plant that grows wild in Asia and tropical Africa (Bulus *and* Abdul, 2007). Increased attention has been paid to the genus *Zizyphus* due to its significant medicinal uses for hypoglycemic, hypotensive, anti-inflammatory, antimicrobial, antioxidant, anti-tumor, liver protective and immune function improvement purposes.

In Sudan, the fruit of Z. *spina- christi* is known by the colloquial name Nabag. The fruit has drawn a great deal of attention during the period of famine-strike where people have used it for a substantial time as the sole source of food. As it can have this role as a source of food, information regarding the chemical composition of the fruit is scarce (Abdel azim *et al*., 1987).

The objectives of this study are to determine the proximate analysis of *Zizyph.spina –Christi* (Nabag) seeds, physical and chemical properties and fatty acids composition of seeds crude oil.

Materials and Methods

The fruits of Sidr plant (*Z. spina-christi*), were obtained from local market (Abo Jahal, El Obeid City, Northern Kordofan Estate, Sudan. The fruit were first washed and shade dried. The pulp and stone were separated. Stones were ground, using a hammer mill, to get the seeds (kernels). Kernels were shade dried and powdered to be used in further analysis. Moisture content, oil content, protein content, crude fiber, ash content, refractive index (RI) oil density, peroxide value (PV) acid value (FFA) , iodine value , saponification value and colour were determined according to the AOAC method (2010). The viscosity of oil samples was determined by using Oswald — u- Tube, viscometer No 7647 (A.O.C.S, 2006). Fatty acid composition of oil was determined by gas chromatography apparatus (Py E-UNICAM model GCD). (ACMLT, 1990).

Results and Discussion

1- The proximate analysis of sidr seed kernels

The proximate analysis of sidr (*Zizyphus spina-christi*) seed kernels was presented in table (1). Results indicated the existence of heterogeneous sources of nutrients and energy from this wild edible plant. Considerable amount of carbohydrates, oil and protein contents were observed. The proximate composition shows that the carbohydrates were the highest constituent (36.38%) while the present ash was lowest (4.47%) quantity in the seed kernels. Results were also indicated that carbohydrate was the main

component as it forms 36.36% followed by fats 28.96% and proteins 16.03%. Similar result of oil content (28.5%) was reported by Abdel Azim *et al*., (1987).Even so, it was highest than (4.25%) and (1.94%) which reported by Magdi (2009) and Amoo and Jokotagba (2012) respectively. The high percentage of oil makes this seed a distinct potential for the oil industry. The seed kernel is also rich in proteins; therefore it could be utilized as feed or food stocks for animals.

The reported moisture content of sidr seed kernels was quite low (4.59%), which almost similar to (4.7%) and (4.46%) reported by Abdel Azim *et al.*, (1987) and Magdi (2009), but it's lower than (16.83) reported by Amoo and Jokotagba (2012). This might be advantageous in terms of the shelf life of the seeds. Low moisture content is important for keeping quality and shelf life of seeds as low moisture decreases the probability of microbial growth, unwanted fermentation, premature seed germination, and many undesirable biochemical changes normally associated with these processes (Onilude *et al*., 2010). Low moisture content as observed in this work confirm good stability (keeping quality). The fiber contents of seed kernels are moderately high 9.57%. Dietary fiber is known to have cholesterol-lowering properties (Gunness and Gidley, 2010).

Table1: Proximate chemical composition of *Z. spina-christi* seed (kernels**)**

Constituent	**Mean values (%)**
Moisture content	4.59±0.055
Oil content	28.96±0.144
Protein content	16.03±0.560
Crude fiber	9.57±0.441
Ash content	4.47±1.351
Total carbohydrate	36.38±0.776

* value as mean ± SE (Standard Error).

The level of ash content in the sample of sidr seed kernel was found to be 4.47%. The ash content is an indicative for the mineral contents and this ratio means that they either deficient or moderately adequate (Sawe *et al.*, 1998).

The variation in results as compared to other authors can be attributed to environmental factors such as soil, temperature, rain fall which have an impact on nutritional contents of the plants. In spite of the variations, the proximate composition analysis indicated that this wild edible plant might have significant amount of nutrients and energy to supplement meals and if properly evaluated it could be a good income sources for households.

The relatively high carbohydrate, fat, and protein content of the seeds kernels of *Z. spina- christi* make it a ready source of energy via glycolysis,

beta-oxidation and amino acid oxidation reactions, respectively. Amino acids from protein will also serve as precursors for repair and replacement for worn-out tissues via protein synthesis. The fatty acids may be utilized in the formation of phospholipids during membrane organization (Sander and Ronald, 2010).

2 - Physical properties of *Z. spina-christi* seed oil

The physical characteristics of *Z. spina-christi* seed oil is given in Table (2). It was found to be a red-yellowish liquid at ambient temperature and had a refractive index about 1.467. The density of the extracted oil was 0.9339 which more or less similar to the density values of edible oils such cottonseed, olive corn oils. The density of oil depends on the method of extraction. The viscosity of the oil was high (33.26), possibly because of the water that was bound in the oil during extraction. Viscosity is a measure of resistance of a fluid to deform under shear stress (lUPAC, 1987).

Table 2: Physical properties of *Z. spina-christi* seed oil (kernel)

Parameter	**Mean Value**
Refractive index	1.467±0.001
Density	0.9339 ±0.000
Viscosity (cp)	33.26 ±0.386
Colour	**Mean value**
Red	1.16 ±0.120
Yellow	20 ±0.000

* Each value as mean ± SE.

3 - Chemical properties of *Z. spina-christi* seed oil

The chemical properties of *Z. spina-christi* seed oil is given in Table (3). Peroxide value is one of the most widely used tests for oxidative rancidity in oils and fats, peroxide value is a measure of the concentration of peroxides and hydroperoxides formed in the initial stages of lipid oxidation. The peroxide value of *Z. spina-christi* seed oil was in the range adopted as satisfactory (less than 1.0 meq O_2/kg). In general, the lower the peroxide value, the better the quality of the oil, the more stable the oil (Borchani *et al*., 2010). On the other hand the acid value was found to be very low (1.19) and this could be an indicative that the free fatty acid value is on the low side and thus the resulted value shows that this oil is stable

The iodine value of the oil is 117.38 mg/g. The iodine value is a measure of the degree of unsaturation in oil and could be used to quantify the amount of double bonds present in the oil which reflects the susceptibility of oil to oxidation. The iodine value is high and this reflected the presence of sufficient amount of unsaturated fatty esters in the seed oil and this suggests that the oil will be susceptible to oxidative deterioration. The iodine value is a little high above 100 and this places the oil in the drying groups and the oil may find application as a raw material in industries for the manufacture of vegetable oil-based ice cream (Mohammed and Hamza, 2008).

The saponification value was found to be moderately high (181.39 mg/g). Saponification values are highly significant in the making of soap and this result suggests the oil could be used in the production of liquid soap, shampoos and lather shaving creams. Generally, if saponification value is too high, the soap might contain too much alkali which may lead to its

reaction with the skin. If the saponification value too small, the fatty acid salts may not be sufficient enough to remove fat or oil (Auwal *et al*., 2010).

Table3: Chemical properties of *Z. spina-christi* seed oil

Parameter	**Mean value**
Peroxide value (meq O_2/ kg oil)	0.5±0.000
Acid value (mg KOH/ g oil)	1.19±0.077
Saponification value (mg KOH/ g oil)	181.39 ±1.237
Iodine value (g I2/ 100g oil)	117.38 ±0.164

* Each value as mean ± SE.

This study showed presence of relatively high unsaponifiable matter compared with other vegetable oils. In fact all natural fatty acids contain some un- saponifiable matter which may consists of hydrocarbons, long chain aliphatic alcohols, sterols...etc.

4 - Fatty Acid profile

Table (4) shows that the fatty acid composition of *Z. spina-christi* seed oil. The main unsaturated fatty acids found were Oleic acid (monounsaturated) and Linoleic acids (polyunsaturated) which constitute about 79 of the total fatty acids in the oil (57 and 22%, respectively), while the major saturated fatty acids in the seed oil were Palmitic (7.2%), Arachidic acid (6.7%). The presence of high amounts of the essential Linoleic acid suggests that the sidr seed oil is highly nutritious. As the sidr

seed oil is rich in both Oleic and Linoleic acids, it could be used as edible cooking and salad oils or for margarine manufacture.

Oleic acid (omega-9) is a mono-unsaturated fatty acid found in animal and vegetable oils such as olive oil that contains 55-80% of the acid, as glyceride, in quantity greater than any other fatty acid (Rickman *et al.*, 2004). High concentrations of oleic acid can lower blood levels of cholesterol and lower the risk of heart problems (Rickman *et al.*, 2004). The news of the discovery that oleic acid is responsible for protecting breast cancer has stimulated renewed interest in oleic acid. Oleic acid blocks the action of a cancer-causing oncogene, called HER-2/neu, which is found in about 30% of breast cancer patients (Menendez *et al.* 2005). It was also found, that high concentrations of oleic acid can lower blood levels of cholesterol and lower the risk of heart problems (Rickman *et al.*, 2004).

Similarly, Linoleic acids was unequivocally proved to reduce the incidence of tumors and inhibit carcinogenesis and in a number of experimental animal models in experimental animals (NRC, 1996).

Table 4: Fatty acid composition of *Z. spina-christi* seed oil

Fatty acids	**%**
Saturated:	
Palmitic acid	7.2
Stearic acid	4.7
Arachidic	6.7
Unsaturated:	
Oleic acid	57
Linoleic acid	22
Others	2.4

Conclusion

The results of this study have shown that the seed kernels of *Z. spina-christi*, contain appreciable amount of protein, carbohydrate, and fatty acid, a matter that gives it a potential usefulness as a supplement food source in tropical and subtropical regions. The seed kernels contain a relatively high concentration of oil content which rich in unsaturated fatty acid (mono and polyunsaturated fatty acids), make it a potential source of natural antioxidants valued for their sensory, nutritional, and health attributes. The oil could be suitable for fortification of supplement formula in the

manufacture of a variety of popular food products such as snack food, salad dressings, mayonnaises and commercial flavors.

Recommendations

- To use seed kernels of *Z. spina-christi* as a supplement food source in the tropical and subtropical region.
- To use seed kernels oil of *Z. spina-christi* for food purposes.
- More studies should be paid in Nabag seed oil to recognize the shelf life and as natural antioxidant.
- Further studies to other types of Sidr should be considered to exploit the hidden potential of this plant and to investigate their constituents.

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