

Profile of Heavy Metals in Crude Oil Commonly Consumed For Medicinal Purposes in Abakaliki

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Abstract: Levels of Cd, Ni, V and Pb in bonny light crude oil were investigated using atomic absorption spectrophotometer (model-Buck Scientific 210 VGP). The result revealed mean concentration of Cd (0.0485 ± 0.01 ppm), Ni (0.875 ± 0.02), V (0.621 ± 0.02) Pb (0.200 ± 0.01 ppm). The concentrations of toxic metals in the crude oil decrease in the order Ni > V > Cd > Pb. In a comparison to other crude, the level of these metals was not significantly high. The health implications of these heavy metals in crude oil when consumed as oral traditional medicine or applied to the skin were also highlighted. The variation in the levels of the metals were found to be statistically significant ($p < 0.05$) as determined by one way analysis of variance.

Keywords: Toxic metals, crude oil, AAS and Abakaliki.

I. Introduction

Crude oil is a homogenous liquid containing hundreds to thousands of chemical compounds. Though rich in aliphatic and aromatic hydrocarbons, crude oil also contains some trace element like vanadium, nickel, iron, aluminium, copper and some heavy metals like lead and cadmium [1]. Petroleum literally means "rock oil" and it is the second most abundant liquid on Earth. Historically ancient Persians, pre-Columbian Indians and the 10th century Sumatrans used crude oil for its medicinal values. It is recorded that the first oil exported from Venezuela (in 1539) was intended as a gout treatment for the Holy Roman Emperor Charles [2].

In Nigeria due to poverty and illiteracy, many people supplement orthodox medicine with traditional medicine and one of the traditional medicine people consume is crude oil. It has been documented that many people especially in South East and South South geopolitical zones use crude oil for medicinal purposes [3]. It is a common sight in many in the streets, road sides and motor parks to see traders hawking bottled crude oil which many buy. Some drink it while others apply it on their skin in hope it will bring healing to their ailments. The crude oil is at times is mixed with alcohol or water as a drink, and applied into body orifices such as nostrils, ears, anus, vagina, and urethra. Many people use crude oil as a remedy for a variety of ailments, including gastrointestinal disorders, heart burns, athlete feet, leg ulcers, and as antidote to poison. Superstitiously some people use it as a weapon against witchcraft [4]. Crude oil being a mixture of many chemical compounds has the potential to bring about curative effect on the human body. However other potentially toxic compounds in the crude oil can cause a deleterious health challenges when consumed by man. Use of crude oil as traditional medicine has many adverse effects such as formation of vesicles, blisters and epidermolysis for those that apply it on their skin [5]. It can potentially damage the internal organs such as lungs, liver and kidney especially in children and pregnant women [6]. Ingestion of small quantity crude oil has been reported to have caused headaches; gastrointestinal disturbance including nausea; vomiting; diarrhea; dizziness; confusion; loss of balance; eye, nose, throat and lung irritation; respiratory impacts, difficulty breathing and chemical pneumonia and damage to liver, lungs, kidneys and respiratory system. However ingestion of large quantity of crude oil is known to cause the following: cardiovascular system stress; central nervous system effects and neurological damage; blood disorders; aplastic anemia; blood cancers such as leukemia; immune system damage, endocrine and hormone disruption; infertility, birth defects and mutations and ultimately results to death [7].

Poisonous or hazardous components of crude oil are mainly benzene and heavy metals which vary depending on where the crude is sourced. The metal concentration of Nigeria crude oil is less than those from other countries in the world [8]. Metals present in the crude oil include copper, lead, iron, magnesium, sodium, molybdenum, zinc, cadmium, vanadium, titanium, manganese, chromium, cobalt, antimony, uranium, aluminium, tin, barium, gallium, silver and arsenic, among others have been documented by [9]. Some of the above listed ailments are associated with toxic metals such as Cd, Ni, V, Pb which are often component of crude oil. This work evaluated the concentrations of heavy metals in the crude oil consumed as traditional medicine by some people in Abakaliki, Ebonyi State, South East geopolitical zones in Nigeria.

II. Materials And Method

The samples of crude oil used for this study was hawkers who sell them at motor parks in Abakaliki in Ebonyi, State. 25mls of crude oil samples were subjected to ashing process for 48 hours in a muffle furnace at

40°C. This was followed by using HCl and HNO₃ to digest the sample for 5 minute. The digestate was cooled, filtered and spiked into AAS spectrophotometer where concentration of Cd, Ni, V, Pb were determined at wavelengths of 288.9, 232.0, 318.4, 283.3 nanometers respectively.

III. Results

Table 1: Mean Concentration of Heavy Metals in Crude oil

Metals	Mean concentration (ppm)	p-value
Cd	0.485 ± 0.01	0.00
Ni	0.875 ±0.02	0.04
V	0.6 21± 0.02	0.02
Pb	0.200 ±0.01	0.00

IV. Discussion

The concentrations of investigated metals in the crude oil decrease in the order Ni > V > Cd > Pb. the results obtained from this work is comparable with those published by [10] and by [11]. The fact that these toxic metals were in the crude oil is a concern because their presence no matter the concentration is a potential health issue.. Unlike many other constituents of crude oil, metals are non-biodegradable and inside living tissue they tend to undergo biomagnifications [12]. Bioaccumulation of these metals in the body may result to health problems.

When crude oil containing Ni is applied to the skin, it may likely lead to allergic dermatitis known as nickel itch. Nickel is carcinogenic and it adversely affects lungs and nasal cavities. Environmental Protection Agency has recommended daily intake of Ni should be less than 1 mg beyond which is toxic [13].

Vanadium is not regarded as serious a hazard but it has a number of effects on human health, when the consumption is too high such as irritation of lungs, throat, eyes and nasal activities in addition to bronchitis and pneumonia [14]. Toxicity of vanadium includes, cardiac and vascular disease; inflammation of stomach and intestines; damage to the nervous system; bleeding of livers and kidneys

Cadmium damages mainly the kidneys and liver causes cancer, bone fracture, diarrhea, stomach pains and severe vomiting, reproductive failure, damage of central nervous system and DNA. Maximum acceptable concentration for food stuff is around 1 ppm [14].

Lead causes anaemia, headache, convulsions and chronic, nephritis of the kidneys, brain damage and central nervous system disorders musculoskeletal, renal, ocular, immunological, neurological, reproductive, and developmental effects [15]. Dietary intake limit for Pb is 3 mg/week

V. Conclusion

This work showed that the crude oil sample contains toxic metals such as Cd, Ni, V and Pb. The presence, despite the low concentrations, could still lead to serious health hazard considering their cumulative effects in human body.

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