

**CONSEQUENCES OF MERCURY USED IN ARTISANAL  
AND SMALL-SCALE GOLD MINING PROCESSES  
A CASE STUDY OF RIVER NILE STATE SUDAN**

**Ali Muddathir Ali Ahmed  
30000215519011**

**SUMMARY**

*Traditional gold mining (TGM) has been a practice in Sudan since the old times in Merowe and Nubian kingdoms in the third century BC. The practice of gold mining was also found in the eastern Sudan by the Bijah and some Arab immigrants as well as in the Red Sea Mountains (Ali, 2016). The campaigns organized by foreign countries such as Egypt and Britain were the main cause for their invasion on the Sudan. The gold mining practices were very much limited in the past until Sudan was divided into the North Sudan and South Sudan in 2011. Once, Sudan was a country which gross national product was helped by contribution of petroleum. It was because of discovery of petroleum's presence which revenue was directed to finance the country's budget for both North and South when Sudan was still one country. As a result of the secession, the North Sudan lost over 50% of the petroleum revenue and since then experienced serious economic crises which affected the country economic and social stabilization. It was aggravated by the sanctions enforced on the country by the USA. Many sectors in the country, especially agriculture and industry, were affected and the country's economic was nearly collapse when suddenly new hopes appeared for there was the discovery of gold at everywhere in Sudan. Traditional gold mining has flourished since. Hundreds of thousands of people, most of whom were laymen, were engaged in gold extraction. The economy witnessed migration from inside and outside Sudan into the new open source of income. The new source of revenue added to the treasury as much as the loss in the petroleum revenue (Sudanow Magazine, 2014; African Mining Brief, 2014). Gold extraction does not require much finance or advanced technology. Therefore, it suited the unskilled workers to reap high levels of income. However, Gold extraction processing posses hazardous effects on the human health and environment through its use of mercury. The present paper investigates the effect of the mercury use in the extraction of gold by traditional gold mining on human health and natural environment in Alebedia area, Berber Locality in the River Nile State.*

*Traditional gold extraction is often informally practiced by individual groups of communities and in developing countries. The frequent use of mercury in their attempt to recover gold is difficult and practiced under hazardous conditions, especially in the absence of regulations and hygienic standards (Vangsnes, 2018). The mercury may be released into the environment and pose health risk to the miners, their families and to the surrounding communities. Mercury is a heavy metal that occurs in several forms including elemental mercury, inorganic mercury and organic mercury (Rita et al., 2015).*

*The mining activities are referred to as artisanal and small scale gold mining and they are often conducted by hand and primitive tools. Mercury is used to amalgamate gold and separate it from other undesired minerals. ASGM is one of the most significant sources of mercury released into the environment in the developing countries (Santos-Francés et al., 2011). The use of mercury in the extraction of gold has negative effects on the environment and human health. Health records of Abu Hamad's Central Hospital, which is one of the main hospitals close to the study area , received 107 cases of undiagnosed fever from gold mining areas, in addition to some cases of cancer and respiratory diseases, Cancer that was diagnosed in the hospital is due to the use of mercury and cyanide for gold extraction by these gold miners.*

*Artisanal and small-scale gold mining is one of the most significant sources of mercury release into the environment and always use mercury to amalgamate gold and separate it from undesired gangue minerals*

*When the mercury is added to the silt, the mercury sticks to the gold, forming a solid mercury–gold amalgam, this amalgam is then removed from the remaining silt by washing with water and because of inefficient separation of the amalgam in washing or excess mercury use, this excess mercury often makes its way into the land, which can be indirect source of ingestion by workers occupationally exposed and residents in surrounding communities.*

*After washing process the separated amalgam is then heated, which vaporizes the mercury, leaving behind the gold, allowing the vapors to be inhaled by workers occupationally exposed, residents in surrounding communities and part of it deposit in the land.*

*The ambience is the circumference in which pollutants are released and scattered. Once emitted into the ambience, contaminants move away from the source and are dispersed into a large amount of air, while concentrations decrease. The ability of the ambience to dissipate pollution geographically varies from site to site, and temporally, as a function of time. Sometimes the*

*ambience consolidates dispersion of pollutants, and in such cases the pollution concentration is commonly reduced. But at other times, the ambience may block dispersion, and as a result pollution will stack near the source and concentrations will elevate.*

*The study area is located in the River Nile state, Northern Sudan and is one of the most active mining areas where mercury is used in large quantities. The region has populations that are also affected by mercury used in traditional gold mining. The study area is also close to the Nile River 8 km which is being used for different domestic purposes such as cooking, drinking, washing and agriculture craft*

*The methods applied in carrying out this study includes qualitative and quantitative research as well as laboratory for analytical analysis for environmental samples of surface soil and surface water to determine the mercury concentration.*

*The respondents of this research were the workers occupationally exposed and residents surrounding communities in the study area. The total population about 6,000 people distributed as follows 5,000 workers, distributed on four location, each has the total population approximately 1,250 worker per location and 1,000 residents communities, distributed on four community in different location, each has the total population approximately 250 resident per community, They work in different services in the study area and also it is noted that the population numbers increase each year in the study area.*

*The environmental samples of this research were samples of surface water and samples of surface soil, Three random samples of surface water and four random samples of surface soil were collected for distance about one km in mercury pollution area with different direction (Northern, Southern, Eastern, Western and Central). Date and time of sampling and location by Global Positioning System (GPS) and map sheet were obtained by using Geographic Information System (GIS) software (ArcGIS 9.x, USA).*

*In this study used methods of questionnaires. There were some steps; the researcher goes through in analyzing the data to interpret the result of the study as follows:*

*Analyzing the questionnaires of the residents in the surrounding communities and workers occupationally exposed and other respondents to find out how they reacted with threat of gold mining activities.*

*The last one is analyzing the questionnaires by SPSS and Ms. Excel to find quantity and quality of the activities of traditional gold mining.*

*The water samples were collected according to commonly accepted sampling procedures from EPA. Surface soil samples were collected from area adjacent to gold tailings facilities; Background samples were also collected in order to determine the contrast between background mercury concentrations and contamination from each direction of study area; Northern, Southern, Western, Eastern, and Central.*

*The sample of surface water and surface Soil were taken by random sampling from each direction of study area; Northern, southern, western, eastern, and central. The samples of surface water and surface soil were then analyzed in order to determine the mercury concentration contain in each samples.*

*Traditional gold mining activities are associated with natural environmental effect. There are three mining activities. They are grinding, panning, and burning. The researcher found that grinding has effect on land degradation and noise pollution. Panning effect on water pollution is a lot bigger than its effect on air pollution and burning has more effect on air pollution than on water pollution.*

*The impact of factors involved in the activities of mining and their outcome on environment and general health was addressed using quantitative and qualitative in addition to the analytical techniques. The factors which were tested including the level of education and period of living.*

