

Concentrations of Dioxins and Furans Compounds in Port Sudan city

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Abstract

The Port Sudan city suffered from open burning during the long terms. Open burning generation Persistent Organic Pollutants (POPs), the important compounds of this group called Dioxin and furan. Considered Dioxin and furan compounds that are not produced industrially, but are formed unintentionally in the form of secondary products during the manufacture of certain organic compounds chlorofluorocarbons, or during the various combustion processes. It was considered dioxins and furans from organic compounds slow decomposition (Persistent Organic Pollutants (POPs)). There are 75 isomers of dioxin compounds and 135 isomers of furan. The total of isomers are 210 compounds, and the most important of these materials and the most presence and toxicity are only 17 isomers including 7 of dioxin and 10 of furans. The most importantly dioxins, most presence and toxicity is a compound 2, 3, 7, 8-Tetrachlorodibenzodioxin (Formula: $C_{12}H_4Cl_4O_2$, MW: 321.971g/mole).

Two samples were taken from the air at coordinates $19430^{\circ}N$, $37^{\circ}09'613''E$ and $19592^{\circ}N$, $37^{\circ}09'343''E$ respectively. The results appeared that the concentrations of dioxins and furans in the range limit of 0.020 - 0.470Pg/m³, 0.092 - 0.967ng/Kg respectively. This study consider basis line of Port Sudan city.

Keywords: Dioxin and furan compounds, Persistent Organic Pollutants (POPs), The application of nanotechnology

مستخلص:

تعاني مدينة بورتسودان من الحرق المكشوف منذ فترات طويلة والحرق المكشوف يؤدي إلى تكون المركبات العضوية الثابتة وأخطرها مركبي الديوكسين والفيوران. تعتبر مركبات الديوكسين والفيوران من المركبات التي لا تنتج صناعياً ولكنها تتشكل عن غير عمد على شكل نواتج ثانوية أثناء تصنيع بعض المركبات العضوية الكلورية أو أثناء عمليات الإحراق المختلفة، وتعتبر مركبات الديوكسين والفيوران من المركبات العضوية بطيئة التحلل (Persistent Organic Pollutants, (POPs)). يوجد 75 متماكب من مركبات الديوكسينات و135 متماكب من مركبات الفيوران ومجموع المتماكبات هو 210 مركب وأهم هذه المواد وأكثرها تواجداً وسمية هي فقط 17 متماكب منها 7 مركبات الديوكسين و10 مركبات الفيوران. وأهم مركبات الديوكسين وأكثرها تواجداً وسمية

هو مركب (2, 3, 7, 8-Tetrachlorodibenzo[p]dioxin). (Formula: $C_{12}H_4Cl_4O_2$).

تم أخذ عينتين من الهواء وثلاث عينات من الرسوبيات البحرية، وأظهرت التحاليل أن تراكيز الديوكسين والفيوران تتراوح من 0.020 - 0.470Pg/m³ و0.092 - 0.967ng/Kg علي التوالي. تعتبر هذه الدراسة خط أساس للمركبات العضوية الثابتة في

مدينة بورتسودان.

I. Introduction

Red Sea State has experienced rapid growth in all aspects of human, economic and tourism developments. This led to changes in the lives of communities as well as the State's dynamic environment. The change in life activities caused an increased pressure on natural and environmental resources. The rapid industrial growth has increased the accumulation of waste and contaminated materials into the surrounding environment. In the past, the waste of Port Sudan City was collected by two private companies (Elhadaf and Tervk Companies). Currently this is done by government recognized Red Sea Cleaner Company (RSCC). This company has started activity in May 2011. It is expected to deal more efficiently in the field of waste collection and disposal, in order to achieve reduction in capital expenditures and raise the quality of service. Currently solid waste is collected from households twice a week and daily from the markets, hospitals, clinics. It mixed

together and disposed of in landfill outside the city in the direction of the West (Badrregion). Then the waste collected and burned by employees. The following basic information was collected from the waste company [1]:

- The number of houses benefiting from the company's services in Port Sudan according to company estimates, is about 66,900 houses.
- The average number of individuals in the home six members.
- Among the beneficiary population utilizing the service (during the study) is about 401,400 peoples.
- Estimated amount of garbage collected by the company is about 165tons / day, whereas the company capability could raise its efficiency to about 241 tons / day, in addition to 24 tons of daily health waste, Figure 1.

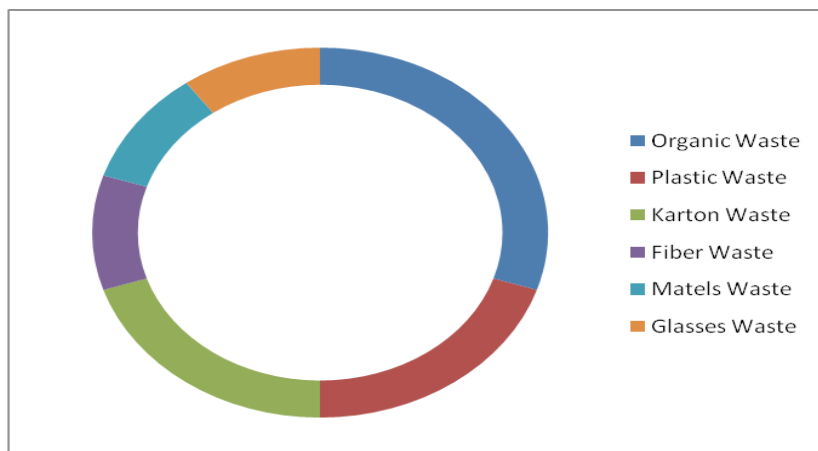


Figure1: The waste in Port Sudan[1]

From the Figure noticed that the organic waste represents a significant part of Port Sudan waste. Therefore the study anticipated basics to design landfill of disposal in an open area for burning Persistent Organic Pollutants (POPs) as shown in Figures (3, 4)). The most dangerous of these compounds are dioxin and furan. The World Health Organization announced in 1996 that dioxin is a carcinogen and thus the organization recommended to reduce the acceptable levels of human exposure from 10 Picogram / kg of body weight per day, to 1- 4 Picogram / kg [2]

2,3,7,8-TetraChloroDibenzo-p-Dioxin (2,3,7,8-TCDD) is formed as an unintentional by-product of incomplete combustion. It may be released to the environment during the combustion of fossil fuels and wood, and during the incineration of municipal and industrial wastes. It causes chloracne in humans, a severe acne-like condition. It is known to be a developmental toxicant in animals, causing skeletal deformities, kidney defects, and weakened immune responses in the offspring of animals exposed to 2,3,7,8-TCDD during pregnancy. Human studies have shown an association between

2,3,7,8-TCDD and soft-tissue sarcomas, lymphomas, and stomach carcinomas. EPA(Environmental Protection Agency[3]) has classified 2,3,7,8- TCDD as a probable human carcinogen (Group B2) [4]. The main Sources(Show Fig.2) of 2,3,7,8-TCDD is primarily released

to the environment during the combustion of fossil fuels (including motor vehicles) and wood (Show Fig. 3&4), and during incineration processes. Most of the exposure of the general population to 2,3,7,8-TCDD is from food, mainly meat, dairy products, and fish [4].

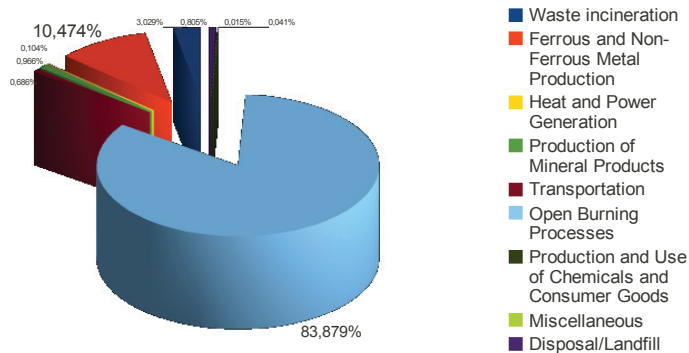


Figure (2): The percentage of dioxin and furan emissions by source categories[5]



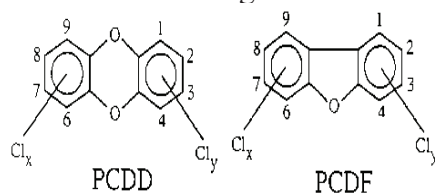
Figure 3: Open burning within the landfill



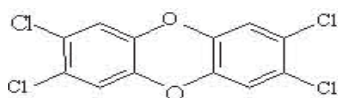
Figure 4: The burning of cables and tries to get out the wires inside the landfill

In general, the greater the proportion of chlorine in the exposed waste combustion as the proportion of the formation of dioxins and furans rose. The dioxin and furan compounds are not produced industrially, but are formed unintentionally in the form of secondary products during the manufacture of certain organochlorine compounds or during the various combustion processes.

Consider dioxins and furans from the slow decomposition of organic compounds. (Persistent Organic Pollutants, POPs). It takes the general formula as following:



There are 75 isomers of dioxin compounds and 135 isomers of compounds furans and total isomers are 210 compound and the most important of these materials and the most presence and toxicity are only 17 isomers including 7 of Dioxin and 10 vehicles furans and, most importantly dioxins and most presence and toxicity is 2,3,7,8-Tetrachlorodibenzo [p] dioxin (TCDD) compound.



2,3,7,8-TetraChloroDibenzo - p -
[Dioxin (TCDD)][6]

Back propagation great and distribution of these compounds in the environment to start the production of chlorine organic compounds dramatically date at the beginning of the thirties of the last century (1930), has been observed decrease in the quantities of dioxins released to the environment in recent years as a result of the application of the correct fundamentals in the industry and waste treatment, and

estimated quantities that launches globally into the environment per year in recent years between 1500-2000 kg / year of dioxins. Dioxins and furans mostly solid at ordinary degree of heat, a qualitative weight higher than one is present in concentrations felt in the fat cells of humans and animals. There are most important physical and chemical properties[6]:-

High density .

Low vapor pressure.

Low water solubility.

High lipophilicity

High thermal stability

Low biodegradability

High bioaccumulation and biomagnification potential

Materials and Methods:

Samples Collection:

We have taken two samples of air (Show Fig.6) and three samples of sediment (Show Fig.7) at coordinates from the following table 1 :

Table (1) : Coordinates of the samples locations

Sample ID	Samples Locations	coordinates	
		Longitude	Latitude
PS/Air/1	Asphalt Mixing Company	37°09' 34.3» E	19°35' 59.2» N
PS/Air/2	Dump Site	37°09' 6.13» E	19°36' 34.0» N
PS/Sed./1	South Port Sudan	37°12' 31.54» E	19°36' 32.68» N
PS/Sed./2	North Port Sudan	37°14' 39.60» E	19°38' 14.80» N
PS/Sed./3	Middle of Port Sudan, Red Sea University, Faculty of Oceanography	37°13' 4.51» E	19°37' 50.0» N

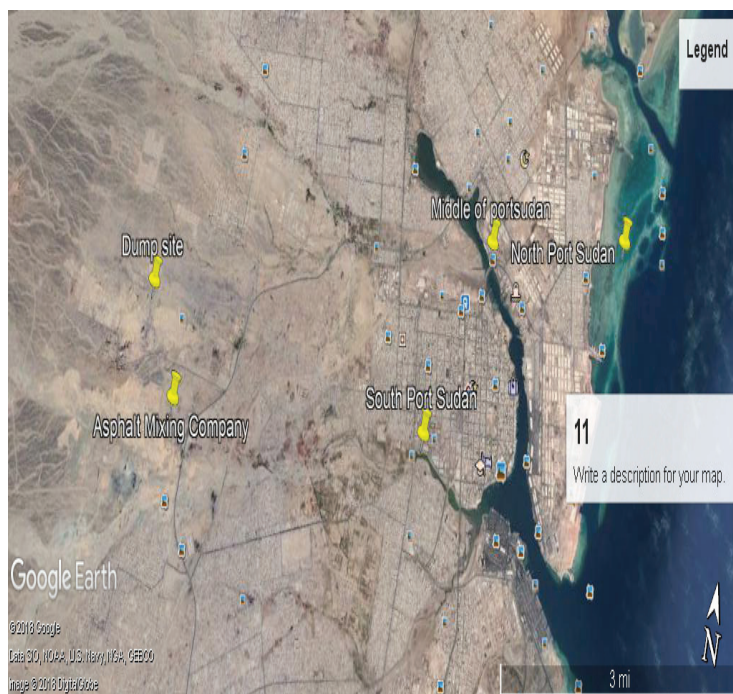


Figure (5) : Positions of taking samples by using Google Earth Pro Portable



Figure (6) : Positions of taking samples of air by using Google Earth Pro Portable

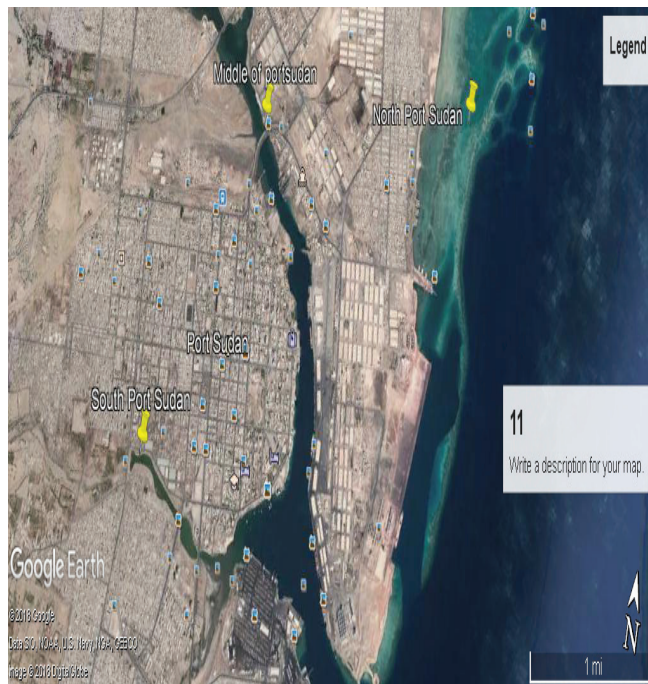


Figure (7) : Positions of taking samples of sediment by using Google Earth Pro Portable

All the samples of air taking by using Ambient air Device, Fig.8



Figure (8): Ambient air Device used to collect air samples

Analysis of Samples:

We have analyzed all the samples in Germany via EurofinsGfA Lab. Service GmbH, Otto-Haha-Str.22, D- 48161Munster, GERMANY .

of persistent organic pollutants in the permissible limits, according the specification of the World Health Organization(WHO) .Table (1) show the results of analyzes of samples.

Results and discussion

Characterization Results:

Analyzes showed that, the proportion

Table 2: Concentrations of dioxins and furans in ambient air samples and marine sediments in Port Sudan city

NO	Sample ID	Location and Description			WHO(2005)-PCDD/F TEQ (lower bound)*	WHO(2005) PCDD/F TEQ (upper bound)*	I-TEQ (NATO/CCMS) excl. LOQ *	I-TEQ (NATO/CCMS) incl. LOQ*
		Sample Location	Longitude	Latitude				
1	PS/Air/1	Asphalt Mixing Company	37°09' 34.3» E	19°35' 59.2» N	0.02	0.055	0.028	0.057
2	PS/Air/2	Dump Site	37°09' 6.13» E	19°36' 34.0» N	0.462	0.470	0.462	0.470
3	PS/Sed./1	South Port Sudan	37°12' 31.54» E	19°36' 32.68» N	0.092	0.979	0.097	0.967
4	PS/Sed./2	North Port Sudan	37°14' 39.60» E	19°38' 14.80» N	0.091	0.835	0.095	0.824
5	PS/Sed./3	Middle of Port Sudan, Red Sea University, Faculty of Oceanography	37°13' 4.51» E	19°37' 50.0» N	0.022	0.953	0.022	0.938

***TEQ values in air sample are in Pg/m³, while in sediments sample are in ng/kg in dry matter.**

***TEQ = Toxic equivalents.**

***PCDD = 1,2,3,7,8-PentaCDD.**

***LOQ = Concentration below the indicated limit of quantification**

The results appeared that the concentrations of dioxins and furans in the range limit of 0.020 - 0.092 Pg/m³, 0.092 - 0.967 ng/Kg respectively. The results is normality but we not

stopped the open burning in landfill the compounds of Dioxin to be accumulation and then cause cancer and other daisies .We were consider this study basis line study of Port Sudan city.

Conclusion:

First: Reduce the rates of entry of dioxins and furans into the human body it was done as follows:

- 1/ reduction of animal fat and greases consumption.
- 2/ moderate intake of fish and prevent eat fish skins.
- 3/ moderation in eating eggs.
- 4/ refrain from smoking and stay away from smoking areas.

Second: Reducing the launch of dioxins and furans in the environment, it was done as follows:

- 1/ Non-use open burning of household waste and other waste and implement the master plan for waste management and the use of other methods more environmentally

friendly.

2/ Toseek to address invasive versions resulting from various forms of incineration.

3/ Secure the equipment needed to book residues that contain amounts of dioxins and furans and prevent it from starting and equipment.

4/ Necessary attention to make laboratory ready, to investigate the concentrations of dioxins and furans in the environment

5 / Help of your best available techniques and best environmental practices issued by UNEP evidence.

6 / Emphasis on the lack of concentration of organic contaminants in imported materials.

7 / periodic follow-up sampling and analysis.

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