

Formaldehyde emissions from wood products and road automotive sources in relation to air temperature variability at urban and west b districts in Unguja Island

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Abstract

Emissions of formaldehyde were quantified from 20 sites in Urban and West B districts allocated in Urban West Region Zanzibar between August and September 2019. In situ measurement was conducted for two separate sources, wood products and road automotive source. Emissions of formaldehyde were measured by using portable instrument known as air detector. The result shows that there was small level of formaldehyde emitted from both sources. From wood product sources, the emission level of formaldehyde was 0.311mgm-3 (urban district), while at west B district the emission was 0.304 mgm-3. For the case of road automotive sources, the level of formaldehyde was 0.32 mgm-3 Urban district and at west B was 0.331 mgm-3.

Keywords: Formaldehyde, health effect, wood product, and road automotive sources.

Introduction

Formaldehyde (HCHO) is a natural occurring organic compound composed of carbon, hydrogen and oxygen [1]. The compound is very important in our life as it applied in several economic activities such as building materials and others [2]. Nevertheless, it has negative effects on both environment as well as human health [3]. The negative impacts may cause acute or chronic problems including severe allergic reactions in the skin, eye and respiratory system, and also causes cancer hence formaldehyde is classified as human carcinogen [4]. Wood is known to contain and emit volatile organic compounds including formaldehyde [5]. In the last years, wood-based panel industry came under discussion for formaldehyde emission; wood as accepted resources contains a little amount of formaldehyde [6]. This can be realized particularly during thermo treatment [7]. Personal vehicles and automobile exhausts is a major source of outdoor formaldehyde, these sources can emit more (HCHO) especially at urban area than rural [8]. Burning of fuels as well as the materials used in making the cars such as clear coats, brake pads mostly are amongst source of HCHO emission [9].

General Objective: The main objective of this study is to quantify the formaldehyde emissions from wood product and road

automotive sources in relation to air temperature variability at urban and west B districts in Unguja Island. Specifically this study based on the following objectives.

1. To measure the level of formaldehyde emitted from wood product and road automotive sources.
2. To compare the amount of formaldehyde emissions between wood product and road automotive sources.

Materials and methods

The study was conducted at Unguja Island in Urban West Region, which includes two Districts Urban and West B district. The site was selected due to the availability of wood product and road automotive source was high in urban than rural.

Sampling procedure: Formaldehyde emissions were quantified at 20 sites in both districts. This study used simple random sampling, sites were given letters and then selected randomly to get amounts of emissions of the gas.

Data Collection: This study used primary quantitative research method to collect data. On every site, the amount of formaldehyde, humidity and temperature was quantified INSITU by using the appropriate air detector. In the field, the parameters were measured five times. Before data collection it was im-

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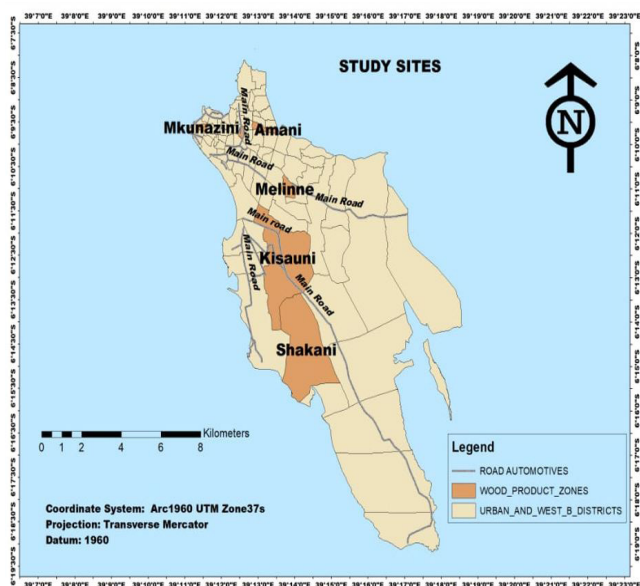


Figure 1: Study area.

Table 1: Study sites showing sources of wood product and road automotive.

Urban district: sites for wood product sources	Urban district: sites for road automotive sources
Mkunazini	Michezani
Mtoni kidatu	Mnazi mmoja
Ushauri	Kijangwani
Kijangwani	Bandarini
Jaani	Mkunazini
West b district: sites for wood product sources	West b district: sites for road automotive sources
Melinne	Kwerekwe
Amani	Amani
Kisauni	Kwabuda
Mombasa	Kivulini
Shakani	Mpendae

Table 2: Emissions of formaldehyde in road automotive source.

District	Parameters	Range	Min	Max	Mean	Std deviation
Urban	Formaldehyde from road automotive source mg/m ³	0.05	0.29	0.34	0.3232	0.01731
West B	Formaldehyde from road automotive source mg/m ³	0.048	0.311	0.359	0.33172	0.022676

Table 2.2: Emission of formaldehyde in wood product sources.

District	Parameters	Range	Min	Max	Mean	Std deviation
Urban	Formaldehyde from wood product source mg/m ³	0.047	0.276	0.322	0.31104	0.019843
West B	Formaldehyde from wood product source mg/m ³	0.018	0.295	0.313	0.30430	0.006976



Figure 2: Air detector tool.

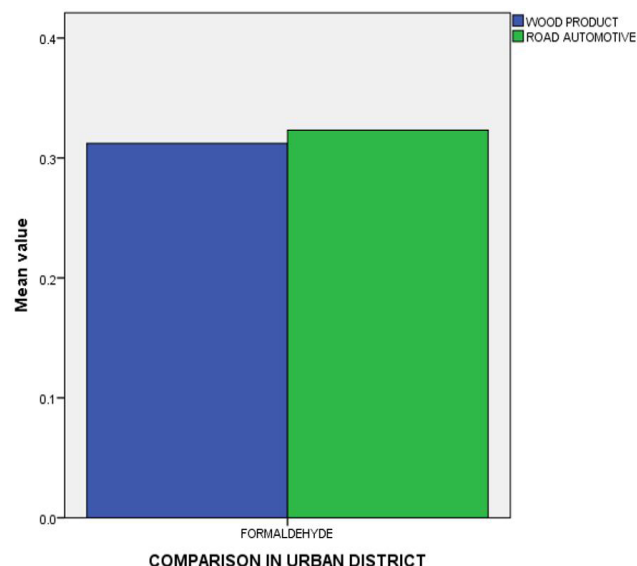


Figure 3: Emissions level of formaldehyde between two sources.

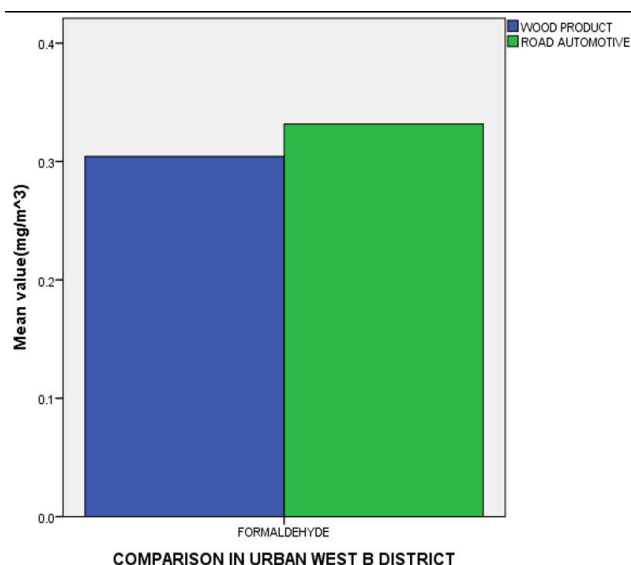


Figure 4: Emission level of formaldehyde between two sources.

portant to calibrate the instrument was calibrated about 15 minutes, prior measurement.

Results and discussion

The results from this study showed that the emission of formaldehyde was too small on both areas.

Results from Road Automotive Source (RAS) in emission levels of formaldehyde at Urban District: Highest emission of formaldehyde was about 0.34 mg/m³, lowest emission of formaldehyde was 0.29 mg/m³. The emission of formaldehyde was low, probably as an area being an open space. Have formaldehyde to evaporate faster in the atmosphere, and easily converted into carbon dioxide. In other areas the emission of formaldehyde was higher because, it was measured in closed area, (low ventilation), also some areas contained many activities that emitted more formaldehyde. Amount of formaldehyde emission was about 0.32 mg/m³ mean value.

Results from Road Automotive Source (RAS) in emission level of formaldehyde in West B District: Highest emission of formaldehyde was about 0.359 mg/m³, lowest emission of formaldehyde was 0.311 mg/m³. The emission of formaldehyde was small because the emission of formaldehyde was measured mostly in open space and formaldehyde being evaporated faster in the atmosphere, Amount of formaldehyde emission was 0.331 mg/m³.

Result from wood product source (WPS) in urban district: Maximum emission of formaldehyde was 0.322 mg/m³, minimum emission was 0.276 mg/m³. The emission of formaldehyde was too small compared to other study, due to the same reasons as explained previously. Amount of formaldehyde emission was about 0.311 mgm⁻³ mean values.

Results from wood product source (WPS) for emission of formaldehyde in West B: Maximum formaldehyde was 0.313 mgm⁻³ and minimum formaldehyde was 0.295 mgm⁻³. The emission of formaldehyde from wood product source was too

small possibly because most of wood was stored for a long time, and was obtained in open space. It also depends on wood species, some wood species may not emit high formaldehyde as reported by (Boehme, 2000) As a result, and the formaldehyde emitted from wood product was around 0.304 mgm⁻³ mean value.

Comparison of formaldehyde emission from wood product and road automotive sources:

The results show that emissions of formaldehyde from road automotive sources was higher than wood product sources, this is because the road automotive have wide range of materials that contain or bound with formaldehyde such as brake pads, car coats and burning fuels, but formaldehyde emission from wood product increase at elevated temperatures and prolonged heating times (10), even in the absence of wood resin [11]. The figure below shows the emissions levels of formaldehyde from wood product and road automotive sources in urban district

Emission of road automotive in urban district was around (0.323 mg/m³) mean value, while from wood product source was about (0.312 mg/m³).

The emissions levels of formaldehyde was higher from road automotive source around (0.3317 mg/m³) mean value rather than wood product source was about (0.304 mg/m³) in urban west B district.

Conclusion

The results show that formaldehyde emission from road automotive source was higher than of the wood product sources due to of the various reasons that were already discussed. Although, the levels of formaldehyde was too small in both sources, but it affect the environments as well as human health if exceed.

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