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## **Applied technology to produce free oxygen in closed room to prevent haze**

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### **Abstract**

Since 1991, haze has been a particularly acute problem in Southeast Asia, especially in Indonesia, Malaysia and Singapore. Many people especially children and old man have been illness by upper respiratory tract infection (URI). The main sources of the haze has been forest fires in Sumatra and Kalimantan. In order to solve this problems, the study was conducted using microalgae (*Chlorella* sp) that cultured in Dahril bottle to produce free oxygen and to prevent haze in closed room.

Dahril bottle made by glass bottle that facilitated by five main components namely, two daylight fluorescent lamps that put on the top and on the bottom of glass bottle, air pump to supply carbodioxide, distilled water as culture media, nutrient and *Chlorella* sp as a seed of microalgae.

First step to operate Dahril bottle is to wash the bottle with clean water and rinse with hot water to kill bacteria and fungi. Then, Dahril bottle was filled with distilled water and enriched with macro and micro nutrients. First sources of nutrient made by pure chemical materials and the second came from wastewater of palm oil mill effluent that was filtered with Dahril filters made by a drum that were, gravel, sand, coal and palm fibre in side as natural filters. The concentrations of two solution (Chemical and palm oil wastewater) used in this study was 10 %. The media culture than inoculate with *Chlorella* with initial density of  $5 \times 10^4$  cells/ml. *Chlorella* has been grow well for two weeks or more.

In order to know the effect of Dahril bottle with *Chlorella* inside to prevent haze and to produce free oxygen in the closed room, two glass boxes were prepared. Both boxes were filled with artificial haze. One of the box was put a Dahril bottle with *Chlorella* growing well inside, and another none. Oxygen concentration in both boxes were measured by oxygenmeter before and after one hour Dahril bottle put inside. The result of this study indicated that Dahril bottle can eliminated haze and produce free oxygen 0.8-1.6 % higher than box without Dahril bottle inside.

*Chlorella* grow well in Dahril bottle. The cell can split two to four times a day. Water colour would be changed from white clear to leave green colour because of Chlorofill-a or green pigment. Photosynthesis continuously conducted with chemical reaction as follow,  $6 \text{CO}_2 + 6 \text{H}_2\text{O} \rightarrow \text{C}_6\text{H}_{12}\text{O}_6 + 6 \text{O}_2$ .

Dahril bottle with *Chlorella* inside will be useful not only for oxygen produce but also for (1) room decorator, (2) carbon dioxide absorb (3) supplement food for animal and human being, (4) natural food for zooplankton and fish larvae (5) as media in teaching and learning by the teacher and student in the school, (6) as media for the preachers to explain the kauniah verses (7) to enhance room humidity and (8) to decrease waste water pollutant.

**Keywords:** *Chlorella* sp, free oxygen, Dahril bottle, haze.

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### **Introduction**

Haze is traditional an atmosphere phenomenon where dust, smoke, smog and other dry particles obscure the clarity of the sky. Since 1991, haze has been a particularly acute problem in Southeast Asia, especially in Indonesia, Malaysia and Singapore. The main sources of the haze has been forest fires in Sumatra and Kalimantan.

In 2015, due to forest fires in Sumatra and Kalimantan Island, Indonesia the capital city of Malaysia, Kuala Lumpur and surrounding areas became shrouded in a pall of noxious fumes, smelling of ash and coal for more than one month. The main sources of haze where the farmers plantation of their ownland and miners have set hundreds of the fires in the forest to clear land during dry weather. Wind blow most of the fumes across the narrow strait of Malacca to Malaysia and Singapore, although parts of Indonesia especially Pelalawan District of Riau are also affected.

In order to solve these problems, the study has been conducted using microalgae (*Chlorella* sp) where cultured in Dahril bottle to produce free oxygen ( $O_2$ ) and to eliminate haze impact in closed room (Dahril, 2015, 2016) Microalgae is a pioneer organisms that living in the ocean for a long period of ancient times. They play an important role to transform carbon dioxide and water to the ingredients for animal and human being and free oxygen in the water and in the air (sky). The microalgae can grow quickly under good and extreme conditions (salt, alkaline, hot, cold, etc). Microalgae is a small, renewable bio-energy for human and environmental sustainable today and tomorrow.

### **Materials and Methods**

Dahril bottle is a container of bottle that is used as a place to culture microalgae in an enclosed area in this study. Dahril bottle is made of glass jars equipped or modified with five main components namely fluorescent lamp as a light source, air pump or water pump as a mean to supply carbon dioxide, distilled water as a culture medium, macro and micro nutrients, and seed of microalgae (*Chlorella* sp) as a seed to be developed.

Two daylight fluorescent bulbs are placed on the top lid and in the bottom of the pedestal/base of the bottle. The light serve as a replacement of sun light for supply of energy for microalgae to photosynthesize by utilizing carbon dioxide ( $CO_2$ ) and water ( $H_2O$ ) which produce carbohydrate ( $C_6H_{12}O_6$ ) and oxygen free ( $O_2$ ). In addition they are also able to take advantage of macro and micro nutrients dissolved in water as inorganic material which could be changed into organic matter in the form of protein, fat, vitamins and minerals that are needed in the lives of animals and humans as food sources.

The initial step in the use of Dahril bottle is by cleaning the bottle well and then rinsed with hot water (boiling), in order to kill bacteria and fungi. Then the Dahril bottle was filled with 4 liters of distilled water with the capacity size of the bottle. 6-liters. Two kinds of nutrient sources were prepared to grow of microalgae. One of the nutrients made by pure chemical that we call it (Dahril Solution 1, and another one made by wastewater from Palm Oil Industry that we call it Dahril Solution 2). The material of Dahril Solution 1 made by Chemical manufactured namely, 1)  $KNO_3$  1000 mg/l, 2)  $MgSO_4$ , 250 mg/l, 3)  $K_2HPO_4$  250 mg/l,  $NaCl$  100 mg/l,  $CaCl_2 \cdot 2H_2O$  10 mg/l, then Fe-solution, 1 ml/l and trace metal solution 1 ml/l. Fe solution made by  $FeSO_4 \cdot 7H_2O$  2000 mg/l and  $Na_2EDTA$  as much as 189 mg/l per 1 litre aquades. Trace metal solutions made by 1)  $H_3BO_3$  2860 gr/l, 2)  $MnSO_4 \cdot 7H_2O$  2500 mg/l,  $ZnSO_4 \cdot 7H_2O$  225 mg/l,  $CuSO_4 \cdot 5H_2O$  71 mg/l dan  $Na_2MoO_4$  21 mg/l per 1 litre aquades. All of these chemical substances can be purchased from the local stores. The second source of the nutrient came from waste

water of palm oil mill effluent that was filtered with Dahril filters made by a drum that were, gravel, sand, coal and palm fibre in side as natural filters. The concentrations of two solution (Chemical and palm oil wastewater) used in this study was 10 %.

Into the water medium then was inoculated the seed of microalgae in initial desity of  $5 \times 10^4$  cells/ml. After that, Dahril bottle was ready to use in his studies. By connecting this bottle with an electric current, both lamps glowed once the air pump was functioning properly. Thus, the process of photosynthesis can take place continuously that will generate free oxygen, while absorbing carbondioxide from the surrounding air

In order to know the effect of Dahril bottle with Microalgae growing inside, to produce free oksigen and to eliminate haze, two boxes were used. The boxes were made by glass with size 50 x 50 x 60 cm. In side of the two boxes were filled with artificial smoke by fire the coconut fiber. One of the box was put Dahril bottle with Chlorella growing inside, and one none. Concentration of free oxygen and temperature were measured in this two boxes, before, after artificial smoke was filed and after one hour Dahril bottle was operated by oxygenmeter merk Lutron DO-5510.

## Results and Discussion

### Chlorella Gowth in Dahril Bottle

It was founded that *Chlorella* sp has been growing well in Dahril bottle with two kinds of nurient sources namely puce chemical ( Dahril Solution 1) and wastewater from palm oil industry (Dahril Solution 2) . The best growth was founded in Dahril Solution 1 with cell density of 6.8 cells/ml in day 12 compared with Dahril Solution 2 (Palm Oil Waste water) with cells density of  $1,4 \times 10^6$  in day 13 as shown in fig1.

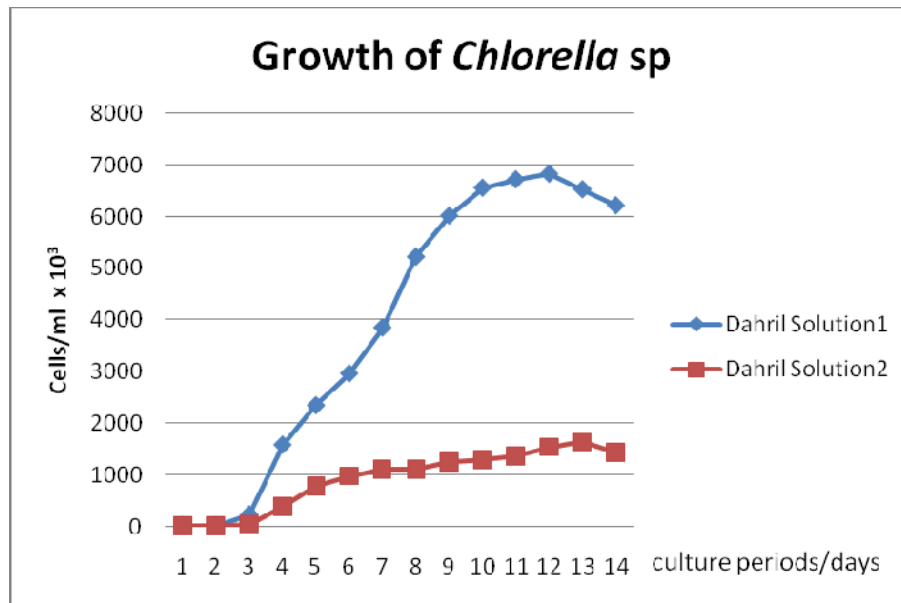


Fig 1. Growth of *Chlorella* sp in Dahril Solution 1 (Pure Chemical) and in Dahril Solution

2 (Palm Oil Wastewater) .

The effect of Dahril bottle with Dahril Solution 1 with Chlorella growing well inside to produced free Oxygen and to eliminate haze was shown in Table 1. Based on the table 1, it could be known that Chlorella could be supply oxygen in the closed room and eliminated haze.

Table 1. Concentration of free oxygen with and without Dahril bottle inside

Treatment	Parameter	Before smoke	After smoke	After Dahril bottle entered
P0	Temperature (°C)	32.54	34.72	33.24
	Oxygen concen (%)	20.4	16.76	18.54
P1	Temperature (°C)	32.56	34.66	33.16
	Oxygen concen (%)	20.4	16.74	19.38
P1-P0	Temperature (°C)	0.02	-0.06	-0.08
	Oxygen concen (%)	0,0	-0.02	0.84

Oxygen is necessary to sustain most terrestrial life especially for human and animal. Oxygen is used in celluler respiration and many major classes of organic molecules in living organisms contain oxygen, such as proteins, nucleic acids, carbohydrates, and fats, as do the major constituent inorganic compounds of animal shells, teeth, and bones. Most of the mass of living organisms is oxygen as a componen of water and carbon dioxide. Oxygen is too chemically reactive to remain a free element in air without being continuously replenished by the photosynthetic action of living organisms. Another form (allotrope) of oxygen, ozone (O<sub>3</sub>), strongly absorbs ultraviolet UVB radiation and the high-attitude ozone layer helps protect the biosphere from ultraviolet radiation. But ozone is a pollutant near the surace where it is a by-product of smog. At low earth orbit altitudes, sufficient atomic oxygen is present to cause corrosion of space craft.(Wikipedia.org)

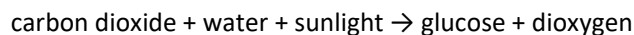
Common use of oxygen includes residential heating, internal combustion engines, production of steel, plastics and textiles, brazing, welding and cutting of steels and other metals, rocket propellant, oxygen therapy, and life support system in aircraft, submarine, spaceflight and diving.

Photosynthesis splits water to liberate O<sub>2</sub> and fixed CO<sub>2</sub> into sugar in what is called a Calvin cycle. In nature, free oxygen is produced by the light-driven splitting of water during oxygenic photosynthesis. According to some estimates, green algae and cyanobacteria in marine environments provide about 70 % of the free oxygen produced on Earth, and the rest is produced by terrestrial plants. Other estimates of the oceanic contribution to atmosphere oxygen are higher, while some estimates are lower, suggesting oceans produced ~ 45 % of Earth's atmospheric oxygen each year.

A simplified overall formula for photosynthesis is



or simply



During a dry season in August to October almost every year, haze has been a main problem in Southeast Asia, especially in Riau and Sumatra. At the time, the oxygen concentration in the atmosphere around Pekanbaru city, the capital of Riau Province, decrease from 20.8 % in normally

to 15 or 10 %. Upper respiratory tract infection (URI) has been the most common acute illness of the people in this condition. Many people especially children under five years old and old man and woman have been ill by upper respiratory tract infection (URI). Some of them died. The main source of the haze comes from forest fires in Sumatra and Borneo. In 2015, due to forest fires in Sumatra, Kalimantan Indonesia the capital city of Malaysia, Kuala Lumpur and surrounding areas also became shrouded in a pall of noxious fumes, smelling of ash and coal for more than one month. By this condition, we suggested that a Dahril bottle with *Chlorella* growing inside could be used to solve these problems.

### **Conclusion**

Based on this study, it could be concluded that a Dahril bottle with microalgae, *Chlorella* sp growing inside could be used to increase the oxygen concentration in a closed room. *Chlorella* sp would be growing well with pure chemical (Dahril Solution 1) as well as wastewater from palm oil industries (Dahril Solution 2) as nutrition for their growth. Therefore, it is hoped that a Dahril bottle with Dahril Solution 1 and 2 as nutrient sources could be adopted as a culture medium of *Chlorella* sp to produce free oxygen and to eliminate haze impact in the closed room.

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