MOVIES (MOTOR VEHICLE EXHAUST MASK) FROM GREEN MUSSELS SHELL WASTE TO REDUCE EXHAUST EMISSION GAS

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1. Introduction

According to Indonesian Traffic Corp Police collected data on 2013, there are 104.211 million units motor vehicles in Indonesia, and most of them are motorcycles. Every year, these numbers increase by 11%. Sa'aduddin, Researcher from Transportation and Logistic Study Centre of Universitas Gadjah Mada (Eka Arifa Rusqiyati, 2016) stated that 70% of carbon dioxide emission in Yogyakarta is coming from motor vehicles. The rests are coming from industrial, office, and trade areas. Those emissions are danger for people's health. Carbon monoxide as the main emission could cause brain, vision, and respiratory problems, and could also cause death. This could also endanger ozone layer in the atmosphere. To solve the problem, it is necessary to modify the engine or the exhaust system, including on using filter from activated charcoal. Infact, people around Depok Beach, Yogyakarta, produce a lot of Green Mussels (*Pernavilidis*) Shell waste, which is potentially used as filter for motor vehicles exhaust. Green Mussels Shell waste can be made into activated charcoal filter to reduce exhaust emission.

2. Research Method

This research was conducted by transforming green mussel shells into activated charcoal. Then, after grinding the shells, its activity is measured. The processes are: drying, carbonating, grinding, scaling, effectiveness test, masking. The following is preparation process:

(a) Cleaned Green Mussels Shells (±2kg) is dried using 90°C oven for 24 hours

(b) Dried shells are carbonated by burning them inside aluminum foil (to prevent air to get into the shell, so that the charcoal is not going to be mixed with the ash) ±150° C for 3 hours.

(c) Carbonated shells are then grinded manually

(d) Carbonated shells powder is then weighed using Triple Beam Balance.

(e) Effectiveness of carbonated shells powder is tested on 10 g, 20 g, 30 g, 40 g, and 50 g activated charcoal by exposing the mask to emitted gas at least 1 minute.

(f) The Activated Charcoal inserted into the mask to measure gas emission. The Measurement value is done by calculating data from the mask

To measure the effectiveness of active charcoal, reduction of CO level, CO_2 level and HC level in exhaust emission are compared with the measurement of mask witout activated charcoal. Emission level is measured by emission test kit from BLH Yogyakarta. Below is the formula.

$$\%PPAA = \frac{\Delta kz}{kz_1} \times 100\%$$

$\% PPAA = effect\ of\ adding\ activated\ charcoal$

$\Delta kz = $ level of emission (after added)(kz_2)
$\qquad - $ initial emission level(kz_1)

$kz_1 = $ initial emission level

3. Result and Analysis

Table 1. Average measurements of Emission Gas

Shell (g)	CO (%)	CO$_2$ (%)	HC (ppm)
WAC	**3,41**	**8,90**	**404**
10	2,51	6,40	302
20	2,90	7,00	342
30	3,31	7,40	362
40	3,36	8,60	385
50	3,39	8,89	402
Reduced (%PPAA)			
Shell (g)	CO (%)	CO$_2$ (%)	HC (%)
10	-26,39	-28,09	-25,25
20	-14,96	-21,35	-15,35
30	-2,93	-16,85	-10,40
40	-1,47	-3,37	-4,70
50	-0,59	-0,11	-0,50

NB: (–) mark means reduce in emission level.
WAC: Without Activated Charcoal

The data presented at the above table is obtained from the average value of the measurement of gas emission for activated charcoal in 10 gram, 20 gram, 30 gram, 40 gram and 50 gram and than compared with the measurement of gas emission without activated charcoal, where the gas emission measurements were carried out each 5 times.

In the measurement of exhaust emission after using activated charcoal from the shell, it resulted that: to reduce CO gas emission level, it is best to

use 10 g of activated charcoal from Green Mussel shell as exhaust mask. It is proved that 10 gram of activated charcoal reduce 26.39% CO emission level. With %PPPA formula too, it is resulted that, CO_2 emission level reduced to 28.09%. It was resulted from using 10 gram of activated charcoal from Green Mussel shell. Beside the other two parameters, HC level is also reduced 25.25% when using 10 gram of activated charcoal from Green Mussel shell.

From all three emitted gas level reduction, it is then concluded that 10 gram of activated charcoal of green mussels shell is best to be used as MOVIES (Motor Vehicle Exhaust Mask) due to the turbulence process in the mask. 10 gram of activated charcoal has more dynamic moving into the mask compared with the movement of heavier charcoal in the mask.

4. Conclusions

Green Mussels Activated Charcoal can be used as motor vehicle exhaust mask to reduce exhaust gas emissions of carbon monoxide (CO) and carbon dioxide (CO_2) and Hydro Carbon (HC). In this case, Activated Charcoal is more influential to lowering gas emissions of carbon monoxide (CO) than lowering of carbon dioxide (CO_2). The utilization of green mussels activated charcoal as motor vehicle exhaust mask is proven effective to lowering gas emissions of carbon monoxide (CO) and Hydro Carbon (HC) in the composition of 10 gram .

5. References

Eka Arifa Rusqiyati, 2016, *Kendaraan Bermotor Sumbang 70 Persen Emisi Karbon Yogyakarta,* on-line media accessed via http://www.antaranews.com/berita/546829/kendaraan-bermotor-sumbang-70-persen-emisi-karbon-yogyakarta, accessed on 01/11/2016 20.18

Husein, A., dan Restadiamawati, 2013, *Pengaruh Rokok Terhadap Peningkatan Pembentukan Mikronukleus pada Mukosa Mulut,*, Undergraduate thesis accessed via http://eprints.undip.ac.id/43917/3/Bab_2.pdf, accessed on 02/11/2016 20.42

Maryanto, D., Mulasari, S. A., dan Suryani, D., 2009, Penurunan Kadar Emisi Gas Buang Karbon Monoksida (CO) dengan Penambahan Arang Aktif pada Kendaraan Bermotor di Yogyakarta, *Jurnal Kesehatan Masyarakat,* **3,** (3); 162-232.

Widodo, S., 2008, Pengaruh pendedahan gas buang kendaraan bermotor berbahan bakar bensin yang mengandung TEL (Tetra Etil Lead) terhadap perilaku agonistik mencit (Mus musculus), *Undergraduate thesis,* UNY Yogyakarta.