



ITDI

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DOST

ENVIRONMENTAL TECHNOLOGY VERIFICATION (ETV)

VERIFICATION STATEMENT

TECHNOLOGY TYPE : **Solid Waste Treatment**

APPLICATION : **Carbonization**

TECHNOLOGY NAME : **CARBONATOR™**

COMPANY : **NASMECH TECHNOLOGY SDN BHD**

Disclaimer

This report is the result of an impartial, consensus-based approach to evaluating innovative environmental technology in accordance with the ETV Technical Protocol. The data presented are believed accurate and the analyses credible. The statements made and conclusions drawn regarding the product evaluated do not, however, amount to an endorsement or approval of the product in general or for any particular application nor a warranty to the performance of the technology that it will always operate as verified.

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This ETV Statement is a summary of the ETV Report of the *CARBONATOR*TM (ETV 09-003).

ETV TEST DESCRIPTION

The ETV Panel of Experts and NASMECH Technology Sdn Bhd agreed to validate the following claims on *Carbonator*TM during the ETV Panel meeting held last March 19, 2009 at the Department of Science and Technology, Bicutan, Taguig City.

1. Emissions of Air Pollutants are within the limits
2. Output Char from the Organic Compound is stable

TECHNOLOGY DESCRIPTION

Based on the technical information provided by NASMECH Technology SDN BHD, *the Carbonator*TM is a unique non polluting and high efficiency waste reduction / recovery treatment equipment which uses the carbonization process to convert organic material into non hazardous, stable and odourless carbon.

The fundamental of this technology is use of thermal energy (dry hot air) through indirect heating concept within a low-medium process temperature, under the absence of oxygen (<1%) and well controlled as well as isolated process treatment condition to achieve the thermal cracking of various organic waste materials.

VERIFICATION OF CLAIMS

Emissions of Air Pollutants are within the Limits

The *Carbonator*TM system employs several Air Pollution Control (APC) equipment to treat flue gas prior to release to the atmosphere. In the APC system, the flue gas is channeled into a combustion type deodorizer, which functioned as thermal destruction chamber to remove possible pollutant present including odor. The flue gas then passes through a Twin Cyclone system to filter out any particulate matter. Finally it passes through a venturi scrubber to remove the remaining pollutants.

Results of emission monitoring conducted by PROCOMA Environmental Sdn Bhd in one of their *Carbonator* Plant located at Canon Opto (M) Sdn Bhd. Jalan, Selisik, Seksyen 26, 40000 Shah Alam, Selangor Darul Ehsan in Malaysia is shown in Table 1. During the monitoring of emission, the input waste being treated using a 1 ton/day capacity *Carbonator*TM system are composed of plastics, mixed diapers, operating gloves, and absorbents. The results are below the maximum limits specified in the National Emission Standard for Source Specific Air Pollutant (NESSAP) promulgated by the Environmental Management Bureau of the Department of Environment and Natural Resources (DENR-EMB).

Table 1. Stack Emission Monitoring Results

Test Parameters	Monitoring Results	Maximum Permissible Limits (NESSAP)	Method of Sampling/Analysis
Chlorine Gas	<0.01 g/Ncm	--	US-EPA Method 26A
Hydrochloric Acid	<0.01 g/Ncm	--	
Heavy Metals			US-EPA Method 29
Chromium (Cr)	<0.001 g/Ncm	--	
Cadmium (Cd)	<0.001 g/Ncm	0.01 g/Ncm	
Copper (Cu)	<0.001 g/Ncm	0.10 g/Ncm	
Lead (Pb)	<0.001 g/Ncm	0.01 g/Ncm	
Arsenic (As)	<0.001 g/Ncm	0.01 g/Ncm	
Mercury (Hg)	<0.001 g/Ncm	0.005 g/Ncm	
Dust Particulate	0.004 g/Ncm	0.200 g/Ncm	US-EPA Method 5
Sulfur Dioxide	<0.001 g/Ncm	0.200 g/Ncm	US-EPA Method 6C
Nitrogen Dioxide	<0.001 g/Ncm	0.500 g/Ncm	US-EPA Method 7E
Carbon Monoxide	<0.001 g/Ncm	0.500 g/Ncm	US-EPA Method 10
Total Organic Carbon	<0.01 g/Ncm	0.01 g/cm	Elemental Analyzer
Benzene	<0.001 g/Ncm	--	US-EPA Method 14A
Dioxins & Furans	0.001 ng/Ncm	0.01 ng/Ncm	US-EPA Method 23

Output char from the Carbonator™ is stable

Samples of output char from the Carbonator™ after testing were collected and analyzed by Chem-Vi of Malaysia for TCLP. The input waste treated during TCLP sample collection were canteen waste, plastics and fabric cloths. The results for all parameters are below the maximum limits specified under the Procedural Manual for Hazardous Waste promulgated by DENR-EMB for inorganic pollutant and also below the maximum limits specified under Title 40 of the Code of Federal Regulations Section 261.24 for organic pollutant as presented in Table 2. Hence, the output char of the carbonator is non-hazardous.

Table 2. TCLP Results of Char Output

Test Parameter	Results	Maximum Limit
Arsenic	ND (<0.01) mg/L	5 ^a mg/L
Barium	ND (<0.01) mg/L	100 ^a mg/L
Benzene	ND (<0.01) mg/L	0.5 ^b mg/L
Cadmium	ND (<0.01) mg/L	5 ^a mg/L
Carbon Tetrachloride	ND (<0.01) mg/L	0.5 ^b mg/L
Chlordane	ND (<0.01) mg/L	0.03 ^b mg/L
Chlorobenzene	ND (<0.01) mg/L	100.0 ^b mg/L
Chloroform	ND (<0.01) mg/L	6.0 ^b mg/L
Chromium	0.020 mg/L	5.0 ^b mg/L
o-Cresol	ND (<0.01) mg/L	200.0 ^b mg/L
m-Cresol	ND (<0.01) mg/L	200.0 ^b mg/L
p-Cresol	ND (<0.01) mg/L	200.0 ^b mg/L
Cresol	ND (<0.01) mg/L	200.0 ^b mg/L
2,4-D	ND (<0.01) mg/L	10.0 ^b mg/L
1,4 - Dichlorobenzene	ND (<0.01) mg/L	7.5 ^b mg/L
1,2-Dichloroethane	ND (<0.01) mg/L	0.5 ^b mg/L
1,1-Dichloroethylene	ND (<0.01) mg/L	0.7 ^b mg/L
2,4-Dinitrotoluene	ND (<0.01) mg/L	0.13 ^b mg/L
Endrin	ND (<0.01) mg/L	0.02 ^b mg/L
Heptachlor (and its epoxide)	ND (<0.001) mg/L	0.008 ^b mg/L
Hexachlorobenzene	ND (<0.01) mg/L	0.13 ^b mg/L
Hexachlorobutadiene	ND (<0.01) mg/L	0.5 ^b mg/L
Hexachloroethane	ND (<0.01) mg/L	3.0 ^b mg/L
Lead	0.016 mg/L	5 ^a mg/L
Lindane	ND (<0.01) mg/L	0.4 ^b mg/L
Mercury	ND (<0.01) mg/L	0.2 ^a mg/L
Metoxychlor	ND (<0.01) mg/L	10.0 ^b mg/L
Methyl Ethyl Ketone	2.45 mg/L	200.0 ^b mg/L
Nitrobenzene	ND (<0.01) mg/L	2.0 ^b mg/L
Pentachlorophenol	ND (<0.01) mg/L	100 ^b mg/L
Pyridine	ND (<0.01) mg/L	5.0 ^b mg/L
Selenium	ND (<0.01) mg/L	1.0 ^a mg/L
Silver	ND (<0.01) mg/L	5.0 ^b mg/L
Tetrachloroethylene	ND (<0.01) mg/L	0.7 ^b mg/L
Toxaphene	ND (<0.01) mg/L	0.5 ^b mg/L
Trichloroethylene	ND (<0.01) mg/L	0.5 ^b mg/L
2,4,5 - Trichlorophenol	ND (<0.01) mg/L	400.0 ^b mg/L
2,4,6 - Trichlorophenol	ND (<0.01) mg/L	2.0 ^b mg/L
2,4,5 - TP (Silvex)	ND (<0.01) mg/L	1.0 ^b mg/L
Vinyl Chloride	ND (<0.01) mg/L	0.2 ^b mg/L

a - Standard based on Table 1-1 of the Procedural Manual, Title III of DAO 92-29 of Hazardous Waste Management.

b - Standard is based on Title 40 of the Code of Federal Regulation