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PLASMA GASIFICATION : A PROVEN TECHNOLOGY

Shyam V. Dighe
Westinghouse Plasma Corporation
Madison, Pennsylvania, USA

INTRODUCTION

Plasma gasification is an efficient and environmentally responsible form of thermal treatment of wastes. In the plasma gasification process, extremely high temperature gases are used to break down the molecular structure of complex carbon-containing materials – such as municipal solid waste (MSW), tires, hazardous waste and sewage sludge – and convert them into synthesis gas (syngas) containing hydrogen and carbon monoxide that can be used to generate power or other sustainable sources of energy. Gasification occurs in an oxygen starved environment so the waste is gasified, not incinerated.

Plasma gasification facilities produce emissions far below the most stringent regulatory requirements in North America. A small amount of bottom ash or fly ash is generated that requires treatment or landfill disposal. Predominantly, the metals and non-combustible inorganic components are melted and captured in an environmentally benign slag, which can be used as construction aggregate. Westinghouse Plasma Corporation (WPC) has developed a plasma gasification system which uses plasma heat in a vertical shaft cupola adopted from the foundry industry.

PLASMA GASIFICATION COMMERCIAL PLANTS

The advancement of plasma gasification has been an international and collaborative effort. Commercial applications have been in operation in Japan since 2002. The Eco-Valley plant in Utashinai, Japan, which Hitachi Metals, Ltd. partially owns and fully operates, uses WPC technology. Eco-Valley transforms up to 280 tons per day (tpd) of MSW and auto shredder residue into steam and electricity which is used internally. Maximizing power output isn't the primary objective of the Eco-Valley facility, and if the plant was designed to optimize power output using a combined cycle mode, it could produce up to 12.0 MW.

Hitachi Metals also commissioned a facility between the towns of Mihama and Mikata in Japan that processes 20 tpd of MSW and 4 tpd of sewage sludge.

OPERATING PLANT PERFORMANCE

Both Japanese facilities meet all environmental regulatory requirements including extremely low levels of dioxins and furans in the stack emissions (less than 0.01 ng/nm3, 10 times lower than Japanese regulations and below North American standards). Typical emissions at these plants are shown in Tables 1, 2, &3.

Table 1: Stack Emissions

Emission Limits (Stack)		Regulation value	Target	Measured Value	
Item	Unit			Test # 1	Test # 2
Dust	g/m3N	0.15	0.02	<0.003	<0.003
HCL	ppm	430	100	39	22
NOx	ppm	250	150	62	82
SOx	ppm	-		<1ppm	<2ppm
CO	ppm	-	30	<29	<27
Dioxins	ng-TEQ/m3N	5	0.05	0.00059	0.00067
Dry gas basis; O2=12%					

Table 2: Slag (Leaching Test)

	Sign	Unit	Regulation Value	Measured value
Cadmium	Cd	mg/liter	<0.01	<0.001
Lead	Pb	mg/liter	<0.01	<0.005
Arsenic	As	mg/liter	<0.01	<0.005
Hexavalent Chrome	Cr+6	mg/liter	<0.05	<0.02
Total Mercury	T-Hg	mg/liter	<0.0005	<0.0005
Selenium	Se	mg/liter	<0.01	<0.005
Dioxin	DXN	ng-TEQ/g	-	0.00000065

Table 3: Fly Ash

Heavy Metal Content		Unit	Measured Value		
			Test # 1	Test # 2	Average
Cadmium	Cd	mg/kg	120	92	106
Lead	Pb	mg/kg	1,440	1,950	1,695
Arsenic	As	mg/kg	21	20	20.5
Hexavalent Chrome	Cr+6	mg/kg	<0.5	<0.5	<0.5
Mercury	Hg	mg/kg	21.1	15.5	18.3
Alkyl Mercury		mg/kg	<0.01	<0.01	<0.01
Selenium	Se	mg/kg	6.7	6.6	6.65
Leaching Test					
	Sign	Unit	Regulation value	Test # 1	Test # 2
Cadmium	Cd	mg/kg	<0.3	<0.001	<0.001
Lead	Pb	mg/kg	<0.3	0.01	0.009
Arsenic	As	mg/liter	<0.3	<0.005	<0.005
Sexivalent Chrome	Cr+6	mg/liter	<1.5	<0.02	<0.02
Mercury	Hg	mg/liter	<0.005	0.0008	<0.0005
Alkyl Mercury		mg/liter	Non detectable	Non detectable	Non detectable
Selenium	Se	mg/liter	<0.3	<0.005	<0.005
Dioxin	DXN	ng-TEQ/g	<3	0.2	0.46

RECENT DEVELOPMENTS

SMS Infrastructures Limited, one of India's largest civil engineering and infrastructure development company, is constructing two 72 tpd plasma gasification hazardous waste disposal plants, located in Pune and Nagpur, India. Operations will commence in Q3 2008.

KiPlasma, a joint venture with Anelmak and Kiplas, the trade association of Chemical, Pharmaceuticals, Rubber and Tire Manufacturers in Turkey, are constructing a 144 tpd plasma gasification plant to industrial and hazardous wastes near Istanbul, Turkey. The operations will commence in Q4 2009.

CONCLUSION

Plasma gasification technology is commercially proven and viable, while also meeting all current regulatory requirements. Plasma gasification is positioned to take hold as a practical, economical and environmentally responsible alternative to conventional forms of waste disposal and power generation.