

METHANOL AS A FUEL IN INDUSTRIAL BOILERS AND COOKSTOVES IN CHINA

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ABOUT MI







- The Methanol Institute (MI) was established in 1989 to lobby the US Congress in support of using methanol and derivatives for high-quality, environmentally-friendly transportation fuels.
- 29 years later, MI is truly recognized as the global trade association for the methanol industry. We have facilitated methanol's expansion to every corner of the world, from our Singapore headquarters and regional offices in Washington DC, Brussels, and Beijing.





Our Members





Committee Structure





METHANOL GROWTH IN APPLICATIONS OF INDUSTRIAL BOILERS AND COOK STOVES IN CHINA



Contents



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- > Methanol as a Cook Stove Fuel
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Methanol's Evolving Global Demand

Methanol Downstream in China 2016 vs 2017



Source: CNFIA Statistics



Fuel Application the Largest Downstream

•Methanol consumption increased to 69.5 MMTs in 2017, 13% incremental to 2016

•Total Fuel Application (Direct Fuel, DME, MTBE) accounting for 25% of the total consumption in 2017

• Formaldehyde share dropped, MTBE share will be affected potential in 2020 when E10 promoted nationally.

•Methanol Direct Fuel in Industrial Boilers and Cookstoves increasingly contributed in the directive fuel blending

•Cooking application suspected to contribute in "Others" in the official statistics

Source: CNFIA Statistics







Methanol Boiler Basics - Structure





Methanol Boiler Basics – Applications and Construction Layout

- Widely used for heating and industrial stream, new built and replacing coal
- Capacity ranged from 1 to 20 t/h
- Fuel: 100% methanol to methanol blends with methanol content over 60% in vol.
- One steam ton capacity consuming 110 kg of methanol, industrial use can be long hours
- Estimated more than 1000 units, consuming over 2 MMTs methanol in 2017

Source: Methanol New Energy Applications in China: Boilers and Cook Stoves





Underground Storage Tank

Methanol Boiler Economics

Fuel	Methanol (Low Price)	Methanol (High Price)	NG (Low Price)	NG (High Price)	Diesel	Coal	Commerical and Industrial Electricity
Unit Price (RMB)	1.8/kg	4/kg	2.2/m3	10/m3	5.5/kg	0.4/kg	0.9/kwh
Unit Price/0.1cal (RMB)	3.8	8.4	2.6	11.8	5.5	0.5	10
Thermal Efficiency	90%	90%	90%	90%	90%	55%	96%
Actual Economics (RMB/0.1 cal)	4.2	9.3	2.9	13.1	6.1	1.45	11

- Methanol Opex comparable to NG depending on regions, helped to fill the clean fuel gap in last winter when NG was short of supply
- Methanol as liquid fuel has superior Capex benefit to NG
- Diesel being eliminated due to its emissions despite its price dropping quickly
- Coal is 100% off the market in most cities of China

Emission Tests in China



- Methanol Fuel Blends: Jin Jjing Da
- Neat Methanol: LinJing
- Methanol showing superior emission benefits to other hard fuels and diesel
- Methanol has no Sulphur and NOx emission is superior than NG boiler
- Methanol boiler easily fulfilling the latest Chinese emission standard even in Key Regions like Beijing, Shanghai etc.

Policy Initiative for Methanol Boilers

Chinese Ministry of Environment Protection Confirmed Methanol Fuel Emission Standard

中华人民共和国 Ministry of Ecology and Environment of the	生态环境部 e People's Republic of China
索引号: 000014672/2015-01507	分类:环境科技及其管理信息、环境标准
发布机关:环境保护部	生成日期: 2015年12月24日
名 称:关于醇基燃料锅炉执行标准有关问题的复函	
又 号: 外图[2012]319号	主题词:
	环境保护部函
	环函[2015]319号
关于	千醇基燃料锅炉执行标准有关问题的复函
河北省环境保护厅: 你厅《关于醇基燃料锅炉执行标准有关问 醇基燃料是一种认甲醇为主,混合有乙酯 化硫、氮氧化物和颗粒物。 欧盟、德国等国外锅炉排放标准中,均将 照≪锅炉大气污染物排放标准》(GB 13271-2 特此函复。	题的请示》(冀环科(2015)178号)收悉。经研究,现函复如下: 9、丙醇等多元醇类和烷烃的低热值液体燃料。充分燃烧后会排放一氧化碳、碳氢化合物、二氧 甲醇、乙醇、沥青、燃料油归类为液体燃料类,执行统一的标准限值,建议醇基燃料的锅炉参 2014)中燃油锅炉的排放控制要求执行。
	环境保护部
	2015年12月24日
抄送: 其他各省、自治区、直辖市环境(保护厅(局)。

The Boiler Burner Authority on New Classification to include Methanol as Burner Fuel

- Burner Test Lab of China Special Equipment Inspection and Research Center
- Alcohol based fuel in liquid fuel category for boiler burners
- Standard will be in effective since 2018
- Original emission concentrations, designing specifications, etc.



锅炉用液体和气体燃料燃烧器技术条件

Specification for liquid fuels and gaseous fuels burners of boilers

在提交反馈意见时,请将您知道的相关专利连同支持性文件一并附上。

(征求意见稿)



CPCIF Group Standards for Methanol Boilers

Methanol Based Fuel Group Standards Under CPCIF

- CAAEFA leading a research group on two Group Standards under CPCIF
- More than 12 cooperative companies from China including boiler manufacturers, fuel suppliers, storage/tanker producers
- MI and MI member Methanex also contributed
- Anticipated to be effective in NOV of 2018

1. Methanol Based Fuel for Boilers

- Burner and fuel composition tests conducted by National Lab of Coal Clean Utilization in Shan Dong University
- Methanol Boiler Fuel is classified into MF50, MF75 and MF100

Important Note: The table referred here is the draft by 5th of June, 2018. Detailed specification numbers may be changed.

No	Item	Index			Test	
NO.	item	MF50	MF75	MF100	method	
1	Methanol content (volume fraction)/%	48-52	73-77	≥98	Appendix A	
2	Density ^a (20°C)/(g/cm ³) no more than	0.86	0.84	0.81	GB/T 1884 、GB/T 611	
3	Lower calorific value/(KJ/Kg) no less than	27170	22990	19228	GB/T 384	
4	Ash content (mass fraction)/% no more than	0.01			GB 508	
5	Condensation point/°C not higher than	-30			GB 510	
6	рН		6~8		See 4.3.1	
7	Sulfur content ^b (mass	0.02 (general area)			GB/T 11140、 SH/T 0253	
	fraction)/% no more than	0.	、SH/T 0689			
8	Nitrogen content ^c (mass 8 fraction)/% no more		0.015 (general area)			
	than	0.	SH/T 070			
9	Chlorine content/(mg/kg) no more than	2			GB/T 18612	
10	Low-temperature anti- phase separation (-20°C, 4h)	Clear and transparent, without phase separation			See 4.3.2	
11	Copper sheet corrosion (50°C, 3h) class no more than	1			GB/T 509	
Notes:						
a) In case of ar	ny discrepancy, the determination re-	sult as per the m	ethod in GB/T 1	884 shall prevai	l;	
b) In case of any discrepancy, the determination result as per the method in SH/T 0689 shall prevail;						
c) In case of any discrepancy, the determination result as per the method in SH/T 0704 shall prevail;						
a) The classific shall be subject	ation of the general area and key ar t to the regulations in GB 13271-201	ea according to 4.	the limitation of	the sulfur and	nitrogen conte	
WWW MFTHΔΝΟΙ Ο						



CPCIF Group Standards for Methanol Boilers

2. Technical requirements for storage and supply facilities of methanol based fuel for boilers

- Specifications in safe use and storage of fuel, on volume, safety distance, precautions, etc.
- Max. Storage capacity less than 150m3, less than 20m3 in the urban built-up area
- Skid Mounted storage allowed, which will facilitate promotion
- Safe distance based on aboveground/under-ground storage tank and different nature of buildings

Table 4.3 The fire protection spacing for the storage tank, unloading (fuel supply) pump, the vent pipe opening and other buildings (structures) (m)+

Building (structure)↔		Underground storage $tank v$		Aboveground storage tank, skid mounted storage tank.		Unloading (fuel supply) pump,	
		90 < V≤150m3 ↔	V≤90m3+²	V > 20m3.₽	V≤20m3.∘	and the vent pipe opening of storage tank∻	÷
Important public building @		35₽	35₽	50₽	50₊∂	35.0	÷
A place near open flame or $\text{spark}_{\scriptscriptstyle \phi}$		17.5 +	12.5+2	25+2	25+2	12.5+	÷
Protection category of civil buildings ↔	Under Category I protection≁	144	11 🖓	20+2	16₊≀	11+2	÷
	Under Category II protection ∂	11.0	8.5+	160	12.0	8.5 0	÷
	Under Category III protection ₽	8.5₽	7.0	12*	10*2	7 🕫	÷
Workshop and warahousa for].

Important Note: The table referred here is the draft by 5th of June, 2018. Detailed specification numbers may be changed.



Other Form of Methanol Burners – Furnaces and Kilns

- Using methanol burner for ceramic sintering, metal alloying, tobacco drying, etc.
- Better ceramic surface finish: less flaws, brighter color due to the clean exhaust gas from methanol
- Better energy efficiency reported: less air intake comparing to NG



Source: Da Wei Energy







Different Methanol Cook Stoves

- A methanol cook stove composed of a methanol fuel storage tank, supply pump, tank, and the stove itself.
- Different forms methanol Cook Stoves: Single stove, dual stoves for stir frying, steaming
- Fuel: 100% methanol to methanol blends (emulsified with water), stored in day tank/cylinder for small amount in the kitchen, and large amount stored outside the kitchen
- Widely used in restaurants, central kitchens: mainly cost driven, to replace LPG and NG







Basic Conditions of Methanol Cook Stoves

- Usually called "Alcohol Based Fuel", complying with two Standards: Alcohol Based Liquid Fuel and Stove for Alcohol based domestic fuel NY312-1997
- Market for Cooking Application estimated over 5 MMTs in China by 2017.

ICS 75. 160. 20 F 19



中华人民共和国国家标准

GB 16663-1996

醇基液体燃料

Alcohol base liquid fuel



1997-07-01 实施

国家技术监督局 发布

Economics and Status

Fuel	Methanol	Natural Gas	Liquefied Petroleum Gas	Diesel	Coal	Electricity
Price per unit mass	¥3.4/kg	¥1.85/m³	¥9.2/kg	¥8.7/kg	¥0.4/kg	¥0.78/kWh
Price per kcal (¥0.0001/kcal)	6.4	2.2	8.1	8.6	0.8	9.1
Thermal Efficiency	56%	75%	50%	40%	30%	80%
Actual Economics (¥0.0001/kcal)	11.4	2.9	16.2	21.5	2.7	11.4

- The prices used are the consumer received prices in the field investigation
- Methanol Opex is among pipeline NG (with subsidy) and LPG
- Chinese kitchens (large capacity for hundreds people) and restaurants have very limited connection the NG with high infrastructure cost
- Methanol as liquid fuel has superior Capex benefit to NG
- Diesel and coal are banned to be used in China

Different Attitude at Local Government Level

- Regions like Tianjin, Gansu, Shanxi, Shannxi, Guilin and Gansu supportive
- Regions like Xiamen, not allowing
- The differences dependent on how safely methanol fuel distributed, local cooking fuel supply conditions, companygovernment engagement, etc.

中华人民共和国农业行业标准

用

NY 312-1997

Stove for alcohol-based domestic fuel

1 范围

本标准规定了醇基民用燃料灶具的型号编制、基本参数、技术要求、试验方法、安全事项、抽样和检 验、标志、包装、运输、贮存。

本标准适用于使用醇基液体燃料的家用炊事灶,其主要燃烧器的额定热负荷为16700kJ/h的灶 具.

2 引用标准

下列标准所包含的条文,通过在本标准中引用而构成为本标准的条文。本标准出版时,所示版本均 为有效。所有标准都会被修订,使用本标准的各方应探讨使用下列标准最新版本的可能性。 GB/T 384-81 石油产品熟值测定法 GB 8913-88 居住区大气中二氧化硫卫生标准检验方法 四氯汞盐盐酸副玫瑰苯胺分光光度法 GB 11738-89 居住区大气中甲醇、丙酮卫生检验标准方法 气相色谱法 GB 12372-90 居住区大气中二氧化氯检验标准方法 改进的 Saltzman 法 CJ 4-83 家用煤气灶

3 型号编制及参数

3.1 型号编制 型号编制用汉语拼音及数字表示。



3.2.2 燃烧器热负荷:大于 10 500 kJ/h,小于 16 700 kJ/h。

中华人民共和国农业部1997-03-18 批准

1997-09-01 实施







Potential Risks of Methanol in Fuel Applications

- Inhalation & Ingestion (Toxicity): no color, rare cases of mis-drinking reported^[1]
- **Fire**: unsafe installation of methanol storage, one exploration on roof top of School Kitchen^[2]
- Emission (cook stoves): lack of indoor air tests on un-burnt methanol and emissions should be paid attention, especially formaldehyde
- Personnel lack of knowledge, especially for the Cook Stoves



2016年12月03日 20:00 来源:中国新闻网 🖓 参与互动 🛛 🕺 😫 💽 🕄 💶 🕢 🧕

中新网哈尔滨12月3日电 (记者 解培华)记者3日从黑龙江省牡丹江市林口县政府部门证实,该县一酒店误将甲醇燃料作为白酒供宾客食用,造成3人死亡。

据悉,近日,牡丹江市林口县三道通镇二村村民祁某某在镇内一家酒店为女儿 举办婚宴,席间误将工业用甲醇燃料作为白酒给宾客食用。

据了解,期间来参加婚宴的大概有几十人。其中,有3名来宾吃席后发生身体 不适,随后就医,经救治无效死亡。

事发后,当地公安机关介入调查。目前,该酒店经理白某某等涉案人员已经被 控制。案件正在进一步侦办中。(完)

甲醇爆炸 陕西省电子信息学校两负责人被带走协查

2015-09-13 07:45 陕西传媒网 评论(1人参与)





Source1: <u>http://www.chinanews.com/sh/2016/12-03/8082797.shtml</u> Source 2: <u>http://sx.sina.com.cn/news/b/2015-09-13/detail-ifxhupin3521362.shtml</u>

Best Practice of Methanol Cook Stoves

- Cookstove with electronic control
- Indoor fuel storage in cylinder
- Flame censors and alarm
- IoT remote monitoring



Source: Shengbao Energy



Publications and Recommendations

MI officially released an industry insight report on methanol as industrial boilers and cook stoves in 2018: http://www.methanol.org/energy/boilercookstoves/





MI Safety Manual and Technical Bulletins

Methanol Safe Handling TECHNICAL BULLETIN

Methanol Drum Transport, Handling, and Storage

INTRODUCTION

cleanup, and fire suppression.

periods of time.

Totes, drums (55 gallon), and cans (5 gallon, and 1 gallon are used to transport, store, and dispense methanol in a wide variety of circumstances by low volume users. Nor bulk transport and storage of hazardous material are regulated activities in the U.S. and some other countries Failure to adhere to applicable regulations may be punishable by fines and imprisonment. Requirements a specific to the country and the circumstances: however

requirements will generally consist of the following, shipping papers, container labeling, transport vehicle



Atmospheric Above Ground Tank Storage of Methanol

INTRODUCTION

corrosion failure.

publications

placarding, driver training and licensing, and availability Guidelines for designing, fabricating, constructing of emergency repines equipment. If you are not a repairing, and safeguarding above-ground methano storage tanks is essentially the same as that for liquid designated hazardous materials carrier, then it may b against the law to transport methanol in totes, drums, and ca transportation fuels such as ethanol and gasoline, Do not transport methanol in your personal vehicle. Do not flammable liquid feed stocks such as benzene, acc home. Storage requires precautions for flammable loading, fi and toluene. However, physical and chemical renethanol are unique to methanol and are not the same a

those of other bulk-stored flammable liquids. Some Never use mouth suction to siphon-transfer methanol. Meth considerations of tank storage are unique to methanol. cumulative and may result in harm if vapor or liquid are inh One important consideration is flammability range. Because the upper flammability limit of methanol is 36

Methanol (CAS: 67-56-1, NIOSH: PC-1400000, DOT: 1230, I percent by volume (vol%) compared to that of gasoline Code Council (ICC) and the National Fire Protection Agence which is 6-7 vol%, methanol vapor can ignite and burn Flammable Liquid" and by the United Nations as a "1993 Cla inside tank vapor space. Transportation (DOT) rank Flammability as a 3 primary h Guidelines for handling IB flammable liquids are provided by Corrosion is another consideration. Methanol is a conductive polar solvent; gasoline is a non-conductive, no

International Fire Code. ICC and NFPA guidelines are recommended as 'best practico or local authority. Within the United States, local authority a

regulations have been developed within the United States by (OSHA), an agency of the federal government. Specific safe l

- regulations for various industries, circumstances, and work e General Industry: 29 Code of Federal Regulations (C
- Construction Industry: 29CFR1926.152
- Shipyard Industry: 29CFR1915.36).

Methanol Safe Handling

Precautions for Loading, Unloading, Transport and Storage of Methanol

Methanol requires that handlers pay particular attention and ignition of methanol and methanol mixtures: 1.) accidental combustion hazard, and 2.) accelerated corrosion of common containment alloys. in methanol service may be high if incompatible materials

protection, and regulator inspection of methanol storage t Hazards associated with loading, unloading, rail and road transport, and tank storage of methanol are es same regardless of intended use. The severity of the Principal considerations of tank storage of methanol are si hazards varies depending on circumstances and ambier cathodic protection, protection from stray currents, in-tar conditions. For example, accidental release of methanol management of inhalation, ingestion, and dermal contact. and vapor generation. Accidental release of methano Methanol Institute recommends that users familiarize the from a gravity transfer system results in liquid pooling implement a disciplined layers of protection program to p and substantially less vapor generation. Combustion and fire suppression. It is essential that fire detection, alarm, re-

API Standard 620. Design and Construction of Large.

Provisions for siting, electrical grounding, berming, and sc ammable liquids are given by the International Code Cos

 NFPA 1 Uniform Fire Code NFPA 30, Flammable and Combustible Liquids Code

(NFPA). Guidelines are available in:

TECHNICAL BULLETIN

to two specific hazards in order to avoid accidental release

from pressurized piping causes immediate liquid flashing Guidance for design, fabrication, construction, and tank set extent when handling methanol.

BEST PRACTICE

 API Standard 653, Tank Inspection, Repair, Alteratis
Best practice for loading, unloading, transporting, and storing methanol is determined by inherent hazards of methanol, and by circumstances associated with blending and handling, and by considerations whih accompar potential accidental release. In order to prevent fire, practices for loading, unloading, transporting, and storing methanol should consider taking the following precautions:

- 1) Avoid accumulation and subsequent discharge of static electricity within low methanol concentration bl which may result from turbulence
- a) Control flow rate into and out of containers to minimize turbulence and avoid accumulation of stati electricity within the flowing liquid;

b) Discharge through a liquid seal dip leg pipe rather by free-falling through air to prevent air entrainment

Methanol is not a static accumulator. This is recognized by the American Petroleum Institute (API) in recommended Practice 2003 (API-RP-200) Protection Against lightfores Arising out of Static, Lightning and Stray Currents which states in part that in most stuations when water-soluble liquid such as alcohold are handled in oncurded conductive equipment they "do not accumulate electrostatic charace because of their relatively high charge "do not apply to the loading of water-soluble products PRP-2003 stipulates that the accumulation of electric charge However, the electrical conductivity of methanol is considera reported as 150,000 picosiemens per meter (Commercial Solven range of 2 X 106 to 2 X 107 picosiemens per meter (Methanex).







Contacts

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Chief EU Representative edekker@methanol.org







