

Abstract

A study of combustion process in Khartoum North Steam Power Plant.

Improving the efficiency of burners and furnaces is one of the key issues for reducing fuel consumption and thus also pollutant gas emissions. Even small improvements in burner energy efficiency and performance can have significant impacts in a continuous operation. For optimizing burner efficiency of Khartoum North Power Station (KNPS) investigation of atomization mixing process was carried out by using Fluent CFD code. The results in steam and heavy fuel oil pressures were found to be 13.2 bars for heavy fuel oil and 8.4 bar for steam, in stead of 10 bar for heavy fuel oil and 8.5 bar for steam. The problems of emission reduction in gaseous of pollutants, particularly of CO, NO_x and SO₂ are definite necessity because of permanent intensification of combustion process and rigorous environmental protection principles. This forces to develop new methods of combustion technologies and burners construction in order to reduce the pollutant emissions. The results indicate that significant NO_x reduction can be obtained through spray steam at post combustion with flue gas recirculation to produce low flame temperature and dissolving NO and SO₂. The resulting steam injection is reduces both thermal and fuel NO_x production. These results indicate the effectiveness of NO_x reduction techniques is directly linked to the amount of injected steam rate and the quality of the fuel. Reductions in NO_x of up to 85% can be obtained simply through controlled use of steam injection. The variations in fuel characteristics such as viscosity, distillation curve, carbon residue, and ash composition limits the potential emissions reduction and maintain stable combustion.

الملخص

دراسة اجراء الاحتراق بمحطة بحري البخاريه

تحسين كفاءة المحارق و غرف الاحتراق للغلايات واحدة من القضايا الرئيسية للحد من استهلاك الوقود وبالتالي من انبعاثات الغازات الملوثة. بالنسبه للمحرق التحسينات الصغيرة في كفاءة استخدام الطاقة والأداء يمكن أن يكون لها تأثيرات هامة بالاضه اذا كان المحرق يعمل باستمرار كمحارق الغلايات. لتحسين كفاءة المحارق العامله بمحطة الخرطوم بحري البخاريه تم التحقيق في عملية الانحلال لزيت الوقود الثقيل بواسطة الخلط بين زيت الوقود الثقيل والبخار و ذلك باستخدام برنامج للحاسوب (CFD) للوصول لضغوط مثاليه للخلط. النتائج التي تم الحصول عليها 13.2 بار لزيت الوقود الثقيل و 8.4 بار للبخار بدلاً من الضغوط المستخدمه بالمحطه وهي 10 بار لزيت الوقود الثقيل و 8.5 بار للبخار.

المشاكل الناتجه من تقليل الانبعاثات الغازيه الملوثة للبيئه الناتجه من عمليات الاحتراق و خاصة اول اكسيد الكربون و اكاسيد النايتروجين بالاضافه الي ثاني اكسيد الكبريت حتي تصبح ملائمه للنسب المحدده و ملائمه للمبادئ الصارمه لحماية البيئه ادى الي الدفع بقوه الي استخدام تكنولوجيا حديثه للاحتراق و تصاميم للمحارق من اجل الحد من الانبعاثات الملوثة. و تشير النتائج الي ان مهمة الحد من اكاسيد النيتروجين يمكن الحصول عليها عن طريق رش بخار الماء في الغازات قبل خروجها الي الهواء و من ثم استخدام جزء من الخليط و اعادته مع هواء الاحتراق. هذه الطريقه

ادت الى انخفاض درجة حرارة اللهب مما ادى الى انخفاض
اكاسيد النيتروجين المكونه حرارياً والمكونه من
النيتروجين المصاحب للوقود و ازالة اول اكسيد الكربون و
ثانى اكسيد الكبريت.

وتشير النتائج إلى فعالية تقني ة حقن البخار في خفض
أكاسيد النيتروجين و ارتباطها مباشرة بقدرة و معدل حقن
البخار بالاضافة الى نوعية الوقود المستخدم . اعطت هذه
الطريقه الى تخفيض أكاسيد النيتروجين بنسبه تصل إلى 85 %
يمكن الحصول عليها بكل بساطة من خلال الاستخدام الحكيم
لحقن البخار.

التباين في خصائص الوقود مثل اللزوجة ، منحنى التقطير
والمخلفات ، وتكوين الرماد تمكن من خفض الانبعاثات
والحفاظ على استقرار الاحتراق

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ACRONYMS

ABMA	American Boiler Manufacturers Association
AEL	Alternative Emission Limit
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
BOOS	Burners out of service
BT	Burner tuning
CAA	Clean Air Act
CEM	Continuous emission monitoring
CO	Carbon monoxide
CO ₂	Carbon dioxide
DOE	U.S. Department of Energy
EPA	U.S. Environmental Protection Agency
FBC	Fluidized-bed combustion
FGD	Flue-gas desulfurization
FGR	Flue gas recirculation
FIR	Fuel-induced recirculation and forced-internal recirculation
HAP	Hazardous air pollutant
ICI	Industrial/commercial/institutional
IFGR	Induced flue-gas recirculation
LEA	Low excess air
LNB	Low-NO _x burner
MCR	Maximum continuous rating
MSW	Municipal solid waste
NO _x	Nitrogen oxides
OFA	Overfire air
PM	Particulate matter
SCA	Staged combustion air
SCR	Selective catalytic reduction
SNCR	Selective noncatalytic reduction
SO ₂	Sulfur dioxide
UHC	Unburned hydrocarbon
ULNB	Ultra low-NO _x burner
VOC	Volatile organic