بسم الله الرحمن الرحيم

# Sudan University of Science and Technology

## College of Graduate Studies

# Factors Affecting Discharge Coefficient of Cooled Industrial Burners

**Thesis Submitted in Partial Fulfillment for the requirement of the degree of M.Sc in Mechanical Engineering**


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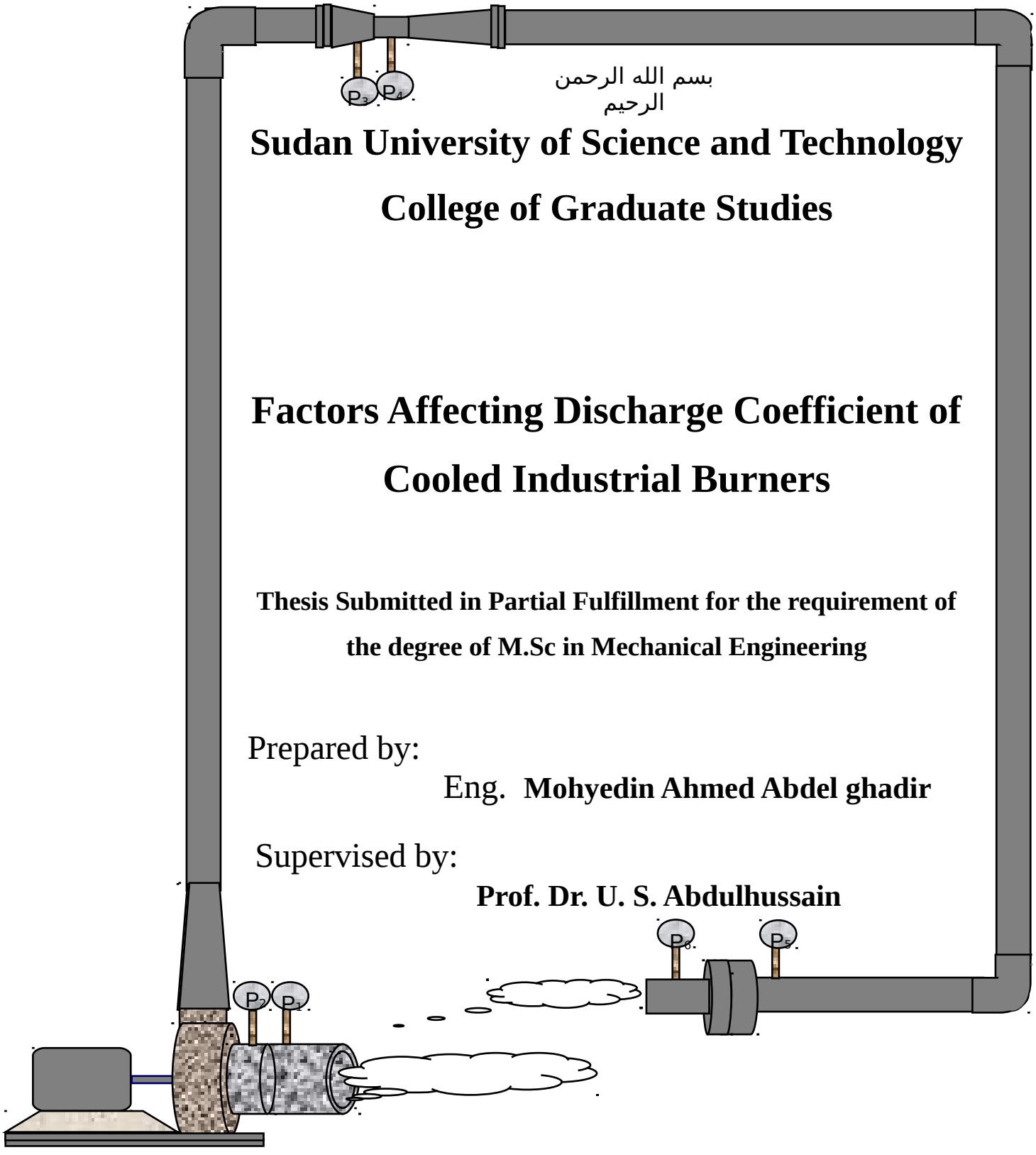


**August 2005**

***Verse***

-: قال تعالى

" و قل رب زدني علما "

صدق الله العظيم

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## *Dedication*

To my Mother, Father's soul and Wife

to my all Family and teachers

## *Acknowledgements*

Indeed my thanks and appreciations to supervisor , **Prof. Dr. U. S. Abdulhussain** for his unlimited and valuable Information and guidance. Also my regards to Sudan University of science and technology (Department of Mechanical Engineering) .Finally my thanks to all teachers and technical staff who are behind achievements.

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# Abstract:

Experimental investigation was made to determine pressure loss coefficient of different types of burners used in industrial combustion applications. Tests were carried out to study the influence of burner geometry and flow variables on pressure loss coefficient, such Reynolds number, porosity, length/diameter ratio, number of holes. The results showed a reasonable agreement when compared with Data obtained by others .


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# الخلاصة:

تم اجراء تجارب لايجاد معاملى التصريف لانواع مختلفة من المحارق

المستخدمة فى التطبيقات الصناعية و تأثير متغيرات الجريان مثل رقم رينولدز ؛ النفاذية ؛ نسبة الطول/القطر وعدد الثقوب على معامل التصريف . اظهرت النتائج توافق معقول عند مقارنتها مع نتائج لباحثين آخرين لتطبيقات أخرى .



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# Nomenclature

| Symbol | Quantity | Coherent SI Unit |
|---|---|---|
| $\Delta P$ | Total pressure drop | $N/m^2$ |
| u | Velocity of air | m/s |
| R | Constant of gas | Kj/kgk |
| T | Ambient temperature | K |
| $A_1$ | Area of pipe | $m^2$ |

| | | |
|---|---|---|
| $A_2$ | Area of orifice plate | $m^2$ |
| M | Mach number | - |
| ρ | Density of air | $Kg/m^3$ |
| $C_d$ | Discharge coefficient | - |
| ε | Expansibility factor | - |
| $C_p$ | Specific heat at constant pressure | Kj/kgk |
| $C_v$ | Specific heat at constant volume | Kj/kgk |
| r | Ratio of the absolute pressure | - |
| $v_c$ | Velocity of vena contracta | m/s |
| $A_c$ | Area of vena contracta | $m^2$ |
| D | Diameter of pipe | m |
| μ | Viscosity of air | Kg/ms |
| $\dot{m}_1$ | Venturi meter mass flow rate | Kg/s |
| $\dot{m}_2$ | Orifice plate mass flow rate | Kg/s |
| $H_1$ | Different Pressure head at venturi meter | m |
| $H_2$ | Different Pressure head at orifice plate | m |
| a | speed of sound | m/s |
| $\dot{m}$ | Actual air mass flow | Kg/s |
| N | Engineering unit conversion factor | - |
| q | Mass – based flow rate | $m^3/s$ |
| d | Orifice bore diameter | m |
| Z | Correction factor | - |
| β | Diameter ratio | - |



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