Sudan University of Science and Technology

Optimizing the Control of the Diesel Backwash Filters Using Foxboro DCS

التحكم في منظومة مرشحات الديزل بطريقة مثلي باستخدام نظام التحكم الموزع فوكس بورو

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الايـة

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

(قَالُوا سُبْحَانَكَ لَا عِلْمَ لَنَا إِلَّا مَا عَلَّمْتَنَا إِنَّكَ أَنْتَ الْعَلِيمُ الْحَكِيمُ)

صَدَقَ اللهُ العَظيم

سورة البقرة

DEDICATION

To the memory of my father; the intellectual, the poet, and the Loving father who inculcated the passion for knowledge in our souls and set us on its path. May Allah, the almighty, set his soul in peace.

To my mother, a loving dedicated mother who loves her family and gives without limits.

I dedicate this work to both of you, you both have strived to keep our family as great, loving, and strong as it is now, and against all odds.

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ABSTRACT

The first and most important stage of the Diesel quality and competency improvement in Diesel Hydro treated unit (DHT) is the backwashing process of the main filters, which is triggered periodically depending on pressure differential (DP) and automatically through the Pneumatic Control System (PCS). The (PCS) system described above represents the main weakness point in the filtration system. It is mainly influenced by many sub-issues related to the (PCS), and resulted in a bigger challenge maintaining and supervising the (PCS). The situation briefly described above eventually leads to low levels of diesel production and low quality. The main question this research is trying to answer is: whether it is possible to turn these systems from Pneumatic to electronic ones, using the existing Distributed Control System (Foxboro).

In this research the virtual Foxboro DCS machine packages (ICC, Fox draw, Fox select, Fox view, etc) were successfully used, and a new program is proposed to control the filters cleaning process with high constancy in monitoring and follow-up. In addition, the proposed program increase the chances for operators to define time frames for; filtering, maintenance, and the diesel quantity used in filtering process, and many other advantages that helps improve the quality, increase final product productively, and extend catalyst life time.

المستخلص

تمرعملية تحسين الديزل بوحدة انتاج الديزل بعدة مراحل أولها وأهمها عملية إزالة الشوائب - الترسبات والعوائق الموجودة في الديزل الخام بواسطة مجموعة من الفلاتر التي تتم عملية نظافتها أوتوماتيكيا عند اتساخها عن طريق نظام تحكم هوائي (Pneumatic Control System) يعمل عند بلوغ فرق جهد الفلتر قيمة معينة. ظلت اشكالية صيانة - متابعة ومراقبة عمل منظومة التحكم الهوائية بالكومبيوتر واحدة من الاشكاليات التي تقلل من كفاءة عملية الترشيح وهذا الأمر يؤثر بصورة مباشرة علي جودة وكمية الديزل المنتج ، لذلك جاءت فكرة هذا البحث لتحويل هذه المنظومة الهوائية المتحكمة في الفلاتر الرئيسية الي منظومةالكترونية باستخدام مجموعة متنوعة من البرامج الموجودة بنظام التحكم الموزع (Foxboro) المستعمل لباقي الوحدة. وفي هذا البحث قام الباحث بتصميم برنامج للتحكم في نظافة الفلاتر بصورة مختلفة عن البرنامج التقليدي الذي يقوم على المنظومة الهوائية. ويعمل هذا البرنامج من خلال تصميم مرشحات مزودة بإشارات تحكمية تسمح للمشغل بمتابعة عمل الفلاتر بصورة دائمة مع اضافة العديد من الميزات للنظام مثل امكانية تحديد زمن عملية الفلترة (الترشيح) وزمن الصيانة ومعرفة الحالة العامة للمنظومة و كمية الديزل المستخدم في عملية الفلترة (الترشيح) وكذلك امكانية التشغيل لأي فلتر والعديد من الميزات التي تزيد من كفاءة وجودة المنتج النهائي.

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ABBREVIATION

F.B.	Function Block
ACUUM	Accumulator
AIN	Analog Input
AM	Manual/Auto
AP	Application Processor
CALCA	Advanced Calculator Block
CIN	Contact Input
COUT	Contact Output
DCS	Distributed Control System
DHT	Diesel Hydro treated Unit
EXC	Exception
FBM	Field Bus Module
HAI	High Alarm Indicator
HLBL	High-Level Batch Language
I/A	Intelligent Automation
IND	Independent
MON	Monitor
OIS	Open Industrial System
Par	Parameter
PCS	Pneumatic Control System
PLB	programmable Logic Block
PID	Proportional/Integral/Derivative
BWF	Backwash Filter
RI	Real Input
RO	Real Output

T	Timer
WP	Workstation Processor
DP	Differential pressure across the filter.
A~F	Filter Elements A ~ F
I	Inlet Input
O	Valve Open
C	Valve Close
T.W.T	Total Washing Time