

DEDICATIONS

To my mother

A strong and gentle soul who taught me to trust in Allah, believe in hard work under any situation and that so much could be done with little .

To my father

For earning an honest living for us and for supporting and encouraging me to believe in my self

To my small family husband and kids

the constant source of love and life.

To my brothers and sisters

To my friends

To you all thank you

Walla

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Abbreviations

PE	Poly Ethylene
HDPE	High Density Poly Ethylene
LDPE	Low Density Poly Ethylene
PET	Poly Ethylene Terephthalate
PVC	Poly Vinyl Chloride
PP	Poly Propylene
PS	Poly Styrene
HIPS	High Impact Poly Styrene
ABS	Acrylonitrile Butadiene Styrene
PC	Poly Carbonate
PU	Poly Urthane
MSW	Municipal Solid Waste
ISO	International Organization for Standardization
WtE	Waste to Energy
EtW	Energy to Waste
SPI	Society of Plastic Industry
MFR	Mechanical Fluidized Reactor
LPG	Liquid Petroleum Gas
ZSM-5	Zeolite Socony Mobil-five
HDO	Hydrodeoxygenation
H ₂ O	Water
CO ₂	Di oxide carbon
CO	Mono oxide carbon
Fe	Iron
Ni	Nickel
Cu	Copper
Na	Sodium
ASTM	American Society for Testing and Materials
GCMS	Gas Chromatography Mass Spectrometry
PLRS	Petroleum Research and Studies Laboratories, Sudan
EPRI	Egyptian Petroleum Research Institute
MCR	Micro Carbon Residue

ABSTRACT

Pyrolysis is the thermal decomposition of materials at elevated temperature in an inert atmosphere. Pyrolysis of plastic waste had become an important method in producing plastic waste oil as a new supply of energy and an alternative fuel system. The benefit from this process is: Treatment of many plastic waste, consequently clean environment and obtaining fuel oil for plastic waste which is a useful final product.

In this work decided to design a simple reactor made from local instruments and easy to move from place to another. The reactor design was studied by using different material and direction. Five types of reactor with different accessories in two directions vertical and horizontal.

The vertical reactor was better than the horizontal one in producing oil. Plastic waste such as HDPE, LDPE, PP or mixture of these with different percentages were used in converting them to oil.

Collected pyrolysis products using different reactor set up were analyzed and tested using GCMS, density, viscosity @ 40 0c, flash point, furan and dioxin, water content, calorific value and other test done by Sudan University of Science and Technology, University of Medical Science, Petroleum Laboratories Research and Studies (PLRS) in Sudan, Agricultural Research Center in Egypt and Egyptian Petroleum Research Institute (EPRI).

Then the final product was used for fueling TukTuk and the performance was found to be good compared with traditional fuel and even better than traditional fuel for TUKTUK as we noticed that there a difference of 2 Km when using 600 ml. Adding small amount of domestic

oil to PP waste oil and reused again in TukTuk gives excellent result. As increased the distance travelled by one compared to PP oil alone. Also the oil from mixed plastic used in cresset and lighting for 9 hours.

All tests results shows good results and confirm that the produced oil from HDPE, LDPE and PP alone is compared to gasoline specifications. Also the produced oil from mixture (HDPE+LDPE+PP) is compared to diesel specifications.

المستخلص

هنالك طرق عديدة للحد من تأثير النفايات البلاستيكية والحفاظ علي البيئة مثل التحلل الحراري للمنتجات البلاستيكية و إعادتها الي مكوناتها الأولية من المشتقات البترولية تستخدم كبديل للطاقة ونظام الوقود البديل عن طريق تعرضها للحرارة المرتفعة بمعزل من الأوكسجين حيث تتفكك وتتحول الي بخار يتم تكثيفه عن طريق الماء وتحويله الي مواد بترولية . في هذا البحث قررت تصميم مفاعل بسيط مصنوع من مواد محلية يمكنه النقل من مكان الي آخر بكل سهولة للتخلص من النفايات الموجودة بالمنطقة و تحويلها لمنتج نهائي مفيد . تمت دراسة وتصميم الجهاز بإستخدام مواد مختلفة مثل : البولي إيثيلين منخفض الكثافة , البولي إيثيلين عالي الكثافة , البولي بروبيلين بأوضاع مختلفة الرأسية و الأفقيه منها . حيث تم تصميم خمس وحدات , ووجد أن التصميم الرأسي هو الأفضل في إنتاج مواد شبيهة بالمنتجات البترولية.

تم تحليل المنتجات النهائية بإستخدام إختبارات متعددة منها : إختبار الكثافة , اللزوجة , نقطة الإشتعال, القيمة الحرارية , قياس نسبة الديوكسين و الفيوران وغيرها من الإختبارات . حيث أجريت التحاليل بمعامل : جامعة السودان للعلوم و التكنولوجيا , جامعة العلوم الطبية, مختبرات النفط المركزية بالسودان , مركز البحوث الزراعية في مصر و معهد بحوث البترول في مصر .

تم تجربة الناتج النهائي كوقود بديل للناقل الشعبي المعروف بإسم الركشة ومقارنته مع الوقود المحلي المستخدم في الركشة , حيث وجد أن الوقود البلاستيكي أفضل من الوقود المحلي في كل التجارب بمختلف الخامات المستخدمة لإنتاج الوقود البديل من البلاستيك بفارق 2 كيلو متر عند إستخدام 600 مل من كلا الوقودين . أيضا عند إضافة نسبة بسيطة من الزيت المعتاد

إضافته الي وقود الركشه الي وقود البولي بروبيلين و مقارنتهم مع بعض , وجد أن النتيجة أفضل من الأول وأيضا أفضل من إستخدام وقود البولي بروبيلين علي حدة .أيضا تم إستخدام الوقود الناتج من أنواع مختلفة من البلاستيك مع بعض في مصباح للإنارة لمعرفة كفاءته حيث تمت الإنارة لمدة 9 ساعات متواصلة من 100 مل من الوقود.

كل التحاليل المسبقة أعلاه أدت الي نتائج جيدة وتم تأكيد تلك النتائج بمقارنتها بمواصفات القياسية للمنتجات البترولية , حيث تمت مقارنة الوقود الناتج من البولي إيثيلين منخفض الكثافة وعالي الكثافة و البولي بروبيلين مع مواصفات البنزين , والوقود الناتج من البلاستيك المختلط بنسب مختلفة مع مواصفات الجاز .

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