

MECHANICAL ENGINEERING (MEC)

MEC 8201 Allen, Denel H. (MS Mech. Eng'g.)
 Studies on gasification of corncobs and its
 utilization.
 1982.

The endeavor to expand the energy based led to several studies on the utilization of offals from agriculture and forest products. Although there were studies on the utilization of ipil-ipil wood, charcoal, coconut shells, coir fibers and rice husks, most of them tried to study ways and means of efficiently converting biomass into salable energy in the form of producer gas.

This study was an investigation on the gasification on corncobs in fixed-bed gas-producers and ways of utilizing the producer gas. The study included a search of a suitable gas-producer for corncobs, application of conventional methods in cleaning the producer gas, and a method of estimating the amount of diesel oil that could be displaced if producer gas utilized in stationary diesel engines.

In this study, there were different designs of gas-producers that were tested, four of the downdraft pressure type. The method of testing the gas-producers was done on two experimental set-ups. The first experimental set-up consisted of using producer gas in a stationary diesel engine while the second set-up utilized the producer gas in a converted oil furnace. In general, corncobs proved to be a good biomass fuel for gas-producers, with a fairly high calorific value and low ash content and uniformly sized, which is important for gasification in a fixed-bed gas generators. However, tar was the main problem in utilizing the producer gas in internal combustion engines. The problem of separating tar from the gas was solved by

providing an efficient gas cleaning device called the wet filter. Preliminary to the study, corncobs were tested for their combustion characteristic. These preliminary studies yielded results on the proximate analysis of corncobs and the heating value of corncobs on dry basis.

The thesis included an extensive survey of the gasification of coal and some of the known utilization of the fuel gas. Some works in the gasification of agricultural waste and forest products were also mentioned.

MEC 8302 **Espiritu, Elmer C. (MS Mech. Eng'g.)**
Atmospheric clearness number of selected Philippine
localities.
1983.

The Jordan-Threlkeld procedure of establishing clearness number of locality was modified to suit Philippine conditions and computerized for easier data manipulation, faster analysis and accurate results.

The modified and computerized Jordan-Threlkeld procedure was used to determine the clearness numbers of Diliman, Quezon City and Victorias, Negros Occidental. The analysis were based on a five-year PAGASA solar data between 1971-1975.

It has been found that the clearness number (CN) of Quezon City and Victorias, Negros Occidental vary with the time of the day and the month of the year according to the following equations:

$$\begin{aligned} \text{CN}_{\text{QC}} &= 4.402 - 0.606T + 0.027T^2 - 0.054M + 0.005M^2 \\ \text{CN}_{\text{VMC}} &= 3.348 - 0.494T + 0.023T^2 - 0.017M + 0.003M^2 \end{aligned}$$

Sample calculations were included to illustrate the clearness number method of calculating direct solar radiation on clear days and the accuracy of its results compared with the Yellot's method.

Listing of the computer programs used were also included for possible use of other investigators who may need to establish the clearness numbers of other Philippine localities.

MEC 8303 **Padullon, David Jr. P. (MS Mech. Eng'g.)**
Gasification of rice hulls and its use as fuel for the
gasoline engine.
1983.

In this thesis, the investigation of using combustible gas from rice hull as fuel to gas engine coupled to an electric generator set is considered. This power system is simple in structure and easy to operate.

This study also includes the search of a suitable grate for continuous ash removal system since ash accumulation at the fuel bed is high during gasification process. It attempts further to investigate the performance of conventional gas cleaning devices such as the condenser, scrubber and the cyclone dust collector.'

The gas producer used in this study was a downdraft, double-fire, suction type gas producer. The method of testing the gas generator was by using the product gas in a 6-cylinder Chevrolet gasoline engine coupled to an alternating current generator with a rated capacity of 10 KW.

For purposes of comparison, the gas engine was operated and tested using producer gas from ipil-ipil wood chips and gasoline fuel. The data obtained from the actual experiments were correlated using Multiple Regression Correlation to construct the graphs and performance curves for evaluation and analysis.

Results show that rice hulls proved to be good biomass fuel for gas generation. However, compared to ipil-ipil, its performance is much lower due to the combustion properties of rice hulls having a low carbon content, low density, high ash content, and high gas tar fraction during dry distillation. So it is considered inferior fuel for gas generators and seldom used. However, there are still many advantages in using rice hulls as fuel.

This study also includes the determination of the proximate analysis and heating value of rice hulls on dry basis. The analysis of the producer gas was not made due to lack of necessary gas analyzer so that gas calorific value was not determined. Instead, estimates for the thermal efficiency of the whole system was deduced to determine the performance when producer gas was used by the engine. Also included in this thesis are computations of the theoretical gas compositions to predict the quality of the producer gas from rice hulls at different values of gasification temperatures.

MEC 8404 Catubao, Gaudencio A. (MS Mech. Eng'g.)
Study on the use of gasoline as a supplementary fuel
for diesel engines.
1984.

A preliminary study has been made on the performance of a two cylinder diesel engine, using gasoline as a supplementary fuel.

The supplementary fuel was aspirated into the engine via a venturi tube connected between the air filter and the intake manifold. During the compression stroke air-gasoline vapor mixture, instead of pure air in the case of normal engine operation, is compressed before the main injection takes place. Only the injection of the main fuel (diesel) initiates ignition and combustion of both supplementary and main fuels.

Tests have shown that up to a certain limit of the amount of gasoline inducted into the engine, the operation was as good as when the engine was operated on diesel fuel alone. Increasing the relative amount of gasoline beyond this limit, a point was reached where a little increase in gasoline caused knocking on the engine. It was only the injection of water that makes an increase in gasoline beyond the knocking point possible. From an operating conditions (constant load and gasoline inspiration) where aspiration is less than the minimum amount (amount at which knock seems to disappear) up to an operating condition where the amount of water aspirated is minimum, an increase in water aspiration correspondingly increases the thermal efficiency. However, from an operating condition where water aspiration is minimum up to any amount significantly higher than this minimum amount, an increase in water aspiration correspondingly decrease the thermal efficiency.

MEC 8605 Si, Willie, C. (MS Mech. Eng'g.)
Kinematic analysis of the Atkinson engine mechanism by
the vector linkage constraint method.
1986.

The different methods available for the analysis of kinematically complex planar mechanisms involve the use of

graphical solutions. This process is tedious in that the velocity and acceleration polygons generated are applicable only to the given phase of the mechanism. This study aims to present an analytical approach via the vector linkage constraint method. The advantage of the method is that the output may be obtained without any knowledge of the intermediate motion parameters. This feature is advantageous when applied to complex mechanisms where a number of intermediate parameters exists. In this study, the method is applied to the Atkinson engine mechanism.

MEC 8906 Deiparine, Edwin O. (MS Mech. Eng'g,)
Kinematic analysis of six-bar mechanism (Stephenson-2)
using complex-algebra method.
1989.

A complex-algebra method for the kinematic analysis of a complex planar mechanism - a six-bar linkage, Stephenson-2 mechanism is presented. The Euler's Law is applied extensively to solve for the motion parameters. A computer program is developed which solves the high degree nonlinear equations and the subsequent long linear equations. A graphical equivalent of the analysis is illustrated and compared to the analytical result. A good agreement between the results of graphical and computer means is observed.

