Effect of Additives on Rheological Properties of Water

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Abstract: Agriculture is one of the main consumers of freshwater products. The challenge of draughts is a major obstacle to the progress of agriculture. In the present study, the rheological properties of the water have been modified to change the flow properties. For the preparation of rice husk powder, a prototype of a machine is proposed. Rice husk powder and starch are used to modify the viscosity. Six samples are prepared using rice husk and starch in varying proportions. The rheological properties are measured at a shear rate of 0-200. The presence of powdered material has significantly altered the viscosity of the water.

1. Introduction

Drought is a condition of land quality where the land is cracked and where it is impossible to grow crops due to less precipitation in the atmosphere and low levels of groundwater is the main cause of drought. The main cause of drought is weather conditions also where the area is near the equator or where the season is hot, the rivers and lakes dry up and the excessive use of groundwater for any purpose, whether domestic or industrial, leads to excessive heat leading to drying of the soil and evaporation of the moisture content, which also leads to drought. This condition lasts for weeks, months and years, and the example of a place in Odisha can also be traced back to decades. There is a district called Kalahandi that has been in a drought-like situation for about twenty years, and no one helped either the state government of the central government was completely demotivated and tried to commit suicide by hanging or drinking poison. The situation was much worse in that place where people didn't get food to eat, or anyone else was there to support poor farmers, so that was the main reason for choosing this research paper and helping farmers grow more by using less water, which is the motto of our project. Drought not only kills the farmer's earnings, but also discourages them from losing hope in farming and becoming industrial labourers, there are many reasons why the drought has led to low groundwater precipitation. Draught is one of the most hazardous natural disaster, due it its impact of maximum number of people via crop failure, unemployment, and insecurity of food safety [1]. Adger [2] analyze the approached use for used for analysis of vulnerability and impact of drought. The analysis provide different dimension to tackle drought with incorporating climate change. Draught is a period of abnormal precipitation. It can be have different form based on intensity, spatial variation and intensity [3]. Present study method is proposed to tackle draught by changing flow property of the water. In this rise husk and starch samples are being tested to observe change in flow properties.

2. Material & methodology
2.1. Material

The method used for this research work was very simple, so we chose qualitative research and analysis, which involves starting from the finding and collection of data, and allowing non-numeric examples of non-numeric data to be made up of audio, video and text. Which we used to gather in-depth knowledge and insight into any problem, to solve it, and to generate new ideas for the future generation. Figure 1-2 displayed the samples with rice husk and starch.

Fig 1. Sample with rice husk and starch

Rice husk samples are being prepared by the crushing and formation of rice husk powder. Powered rice husk is added in 2.5%, and 5% volume fraction in normal water. Another two samples are prepared by using same volume of corn starch in heated water. Finally last two samples are being prepared by using of rice husk and starch mixture of 2.5 and 5% each. Each prepared sample was subjected to intensive ultrasonication as shown in Figure 3. Table 1 listed detail of the sample.
Fig. 3. Sample under ultrasonication

Table 1: Sample details

| Sample name | Rice husk | Starch | Water |
|-------------|-----------|--------|-------|
| Sample 1    | 5         | 0      | 100   |
| Sample 2    | 10        | 0      | 100   |
| Sample 3    | 2.5       | 2.5    | 100   |
| Sample 4    | 5         | 5      | 100   |
| Sample 5    | 0         | 10     | 100   |
| Sample 6    | 0         | 5      | 100   |

2.2 Model:

Figures 4(a-b) show the model of the mixing machine. This is the prototype of a mixer that will grind the rice husk into fine particles so that the fine particles can be mixed with water. First of all, we have to add the rice husk through the conical flask of this machine and inside the machine, there is a grinder that grinds the rice husk and makes it into fine particles after the fine particles come out through the outlet and are collected in the container and used by the farmer.
3. Results & Regression:

Figure 5 shows variation of shear rate with viscosity for Husk (5%). It has been observed that viscosity reduces with increasing shear rate which indicates shear thinning behavior. Further the regression model indicates the variation rate of variation.

\[ y = 11.281x^{0.4} \]
\[ R^2 = 0.4095 \]

**Fig 5: Shear rate variation with viscosity for rice husk (5%)**

Figure 6 shows variation of shear rate with viscosity for rice Husk (10%). It has been observed that 10% rice husk have more viscosity as compared to 5% sample. This is because of increasing thickness of the sample.

\[ y = 508.99x^{0.944} \]
\[ R^2 = 0.9854 \]

**Fig 6: Shear rate variation with viscosity for rice husk (10%)**

Figure 7 shows shear rate with viscosity for rice husk (2.5%) + starch (2.5%). It has been observed that there is linear variation in this case, whereas exponential variation observed for rice husk (5%) & rice husk (10%) case. This change in variation to linear makes variation flow uniform. It can be notice that the range of variation is lower than 10% rice husk case.
Fig 7: Shear rate variation with shear stress for rice husk (2.5%) & Starch (2.5%)

Figure 8 shows variation of viscosity with shear rate for rice husk (5%) & Starch (5%). Increasing the amount of rice husk and starch, viscosity of solution increased. It can be observed that the increasing concentration makes change from linear to again exponential variation.

Fig 8: Variation of viscosity with shear stress for rice husk (5%) & Starch (5%)

Figure 9 and Figure 10 displayed the variation of viscosity with shear rate for plain starch of 5% and 10% concentration respectively. It can be observed that there is almost minor increment in viscosity with increasing starch concentration.
Here by it have been observed that when viscosity is increased with respective to shear rate then there is reduce of water waste in cultivation system and we can reuse rice husk as well as starch to increase in viscosity to maintain the steady flow of water. This is a process of saving water and reusing the waste products which we get in fields.

4. Conclusion:

This project identified challenges and options for efficient crop production in a water restricted ecosystem. Our analysis provides an ecological approach to agricultural management under the conditions of drought and water management. The research project highlights three key points. The first thing to do is to save water and excess water, second to know the use of water and third thing is to reuse the waste to make the water viscous and take control of it. Example Cultivation, Farming Sectors In order to avoid this, our team has
experimented with starch, and rice husk dispersion for varying in flow properties of water. It was observed the sample with plain starch and rice husk displayed shear thinning behaviour. Mixture of rice husk and starch displayed, Newtonian behaviour at lower volume fraction, whereas it shift to shear thinning at higher volume fraction.

By doing so, we conclude that this project provide cost-effective and sustainable method for variation in rheological properties of water to address drought conditions.

References

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