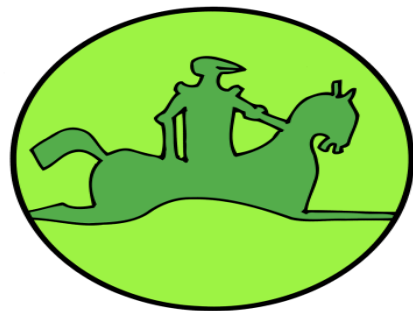


III



IYNT 2015

Problem №17
«Starch Monsters»



Команда «MG 12»

Problem № 17

- A water suspension of starch is placed on a loudspeaker. Investigate and describe the resulting starch monsters.



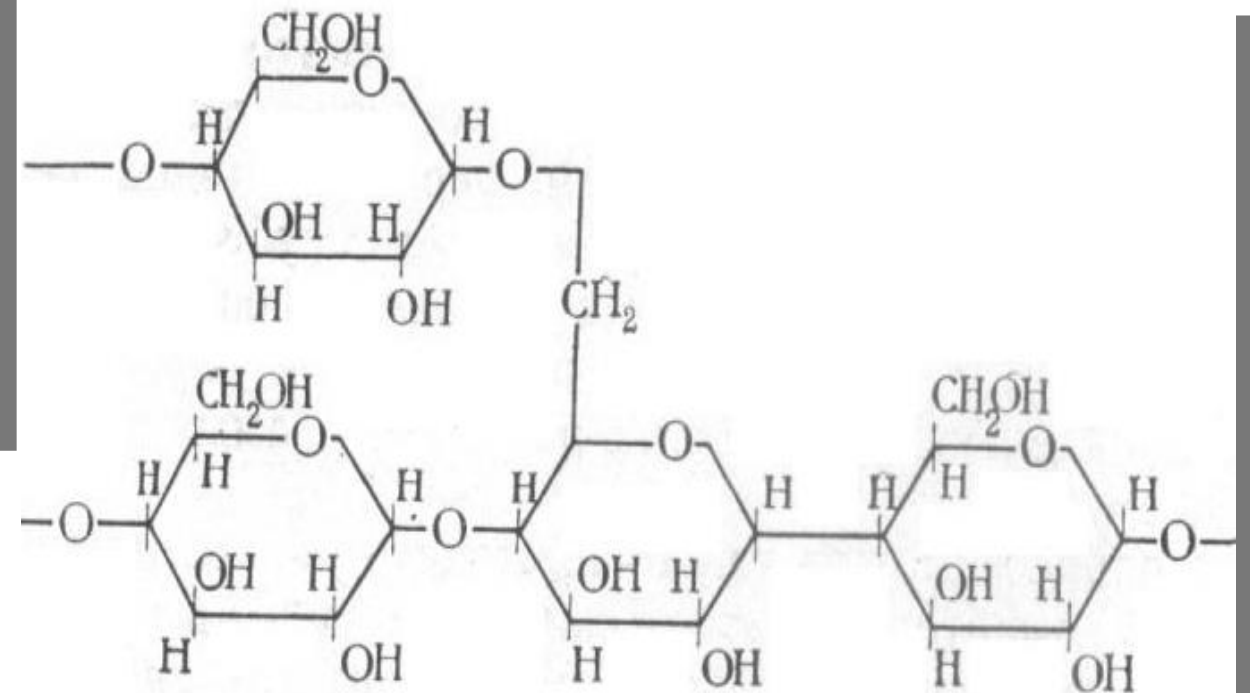


- **Hypothesis:** if we reduce the period of external forces' effect on starch slurry, it shows properties of a solid object.
- **Purpose:** to determine the relation between formation of starch monsters and external parameters.

Tasks:

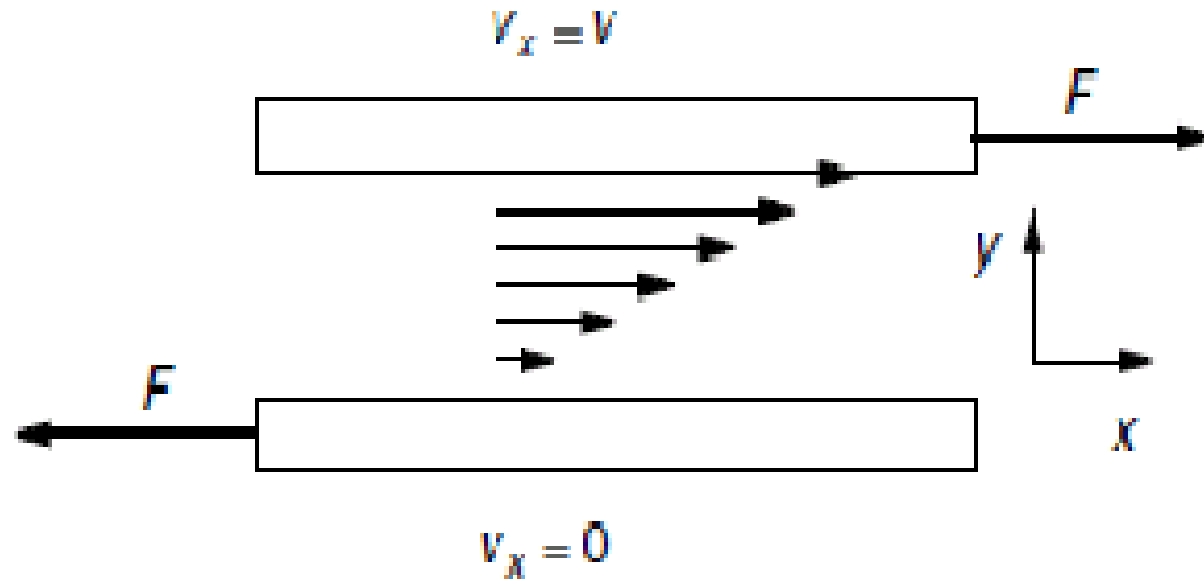
1. To study literature on this subject
2. To see properties of non-Newtonian Liquid
3. To observe the behavior of non-Newtonian Liquid placed on source high-frequency fluctuation
4. To install the flow phenomenon dependence from external parameters
5. To model investigated phenomenon in laboratory conditions

Theoretical process explanation



If velocity gradient affects the liquid's viscosity when it flows - It's a non-Newtonian Liquid.

$$\frac{dv}{dy}$$



Velocity gradient defines the change of velocity per a distance unit, when one layer of liquid transits into another in the direction of OY, which is perpendicular to the direction of layers' movement.

Characteristic curves flow of non-Newtonian Liquid

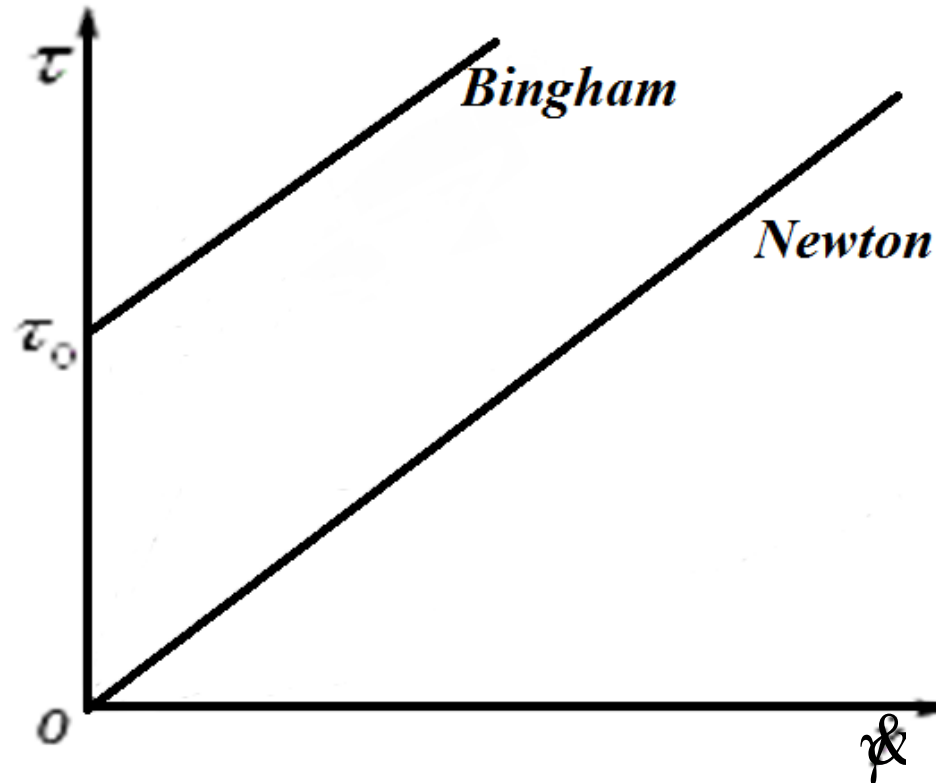
τ - Is voltage in the liquid, under the influence of an external force;

τ_0 - Is yield strength, it characterizes the plastic properties of the material;

$\dot{\gamma}$ - Velocity gradient

Equation of flow of non-Newtonian fluids

$$\tau - \tau_0 = \mu \cdot dv/dn$$



Experimental part

Purpose: to establish the relation between the magnitude of the driving force impacting on the starch slurry and the probability of occurrence of "monsters".



40 dB



70 dB

Experimental part



> 70 dB

Experimental part



Photo 1



Photo 2

Experimental part



The molecules of corn starch have less length as consequence they are more mobile. Hitches in corn suspension are weaker.



Conclusion: the corn starch slurry gives a greater numbers of “monsters” with equal proportion of starch and water, when listening the same music.

Conclusions:

1. The appearance of the starch "monsters" is explained with non-Newtonian liquid properties.
2. The number of "monsters" formed on the surface of liquid placed on the speaker, depends on the frequency and amplitude of the sound vibrations.
3. These experiments showed that the formation of starch monsters is affected by the vibration amplitude of the speakers' membrane, as well as the frequency of these vibrations.

Sources:

1. Physics 10 class LE Gendenshteyn, Yu.I.Dik 2012
2. Non-Newtonian fluid W. L. Wilkinson, 1981
3. <http://nsportal.ru/ap/library/nauchno-tekhnicheskoe-tvorchestvo/2014/12/15/nenyutonovskaya-zhidkost-uchebno>
4. http://edu.sernam.ru/lect_gam.php?id=35
5. <http://chem21.info/info/714921>