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PERFORMANCE OPTIMIZATION OF AN ORGANIC MUD AGITATOR SCREW

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Abstract. *Due to the special performances obtained by means of the optimisation method applied to the axial runners of run-of-river hydraulic turbines and of wind turbines, as well as in the case of the screws for boat propulsion, perfected by the first of the authors [1] ÷ [10], in this work one extend the application of this method at the case of an organic mud agitator screw for fermentation and biogas production. One presents the obtaining of the bio liquid circulation minimal velocity in the two possible cases [3]: extracting the fluid velocity from the peripheral force exerted by the runner, as well as from the mechanical power consumed for its driving. After the obtaining of the optimal relative peripheral angle one determines also the optimal incidence angles of the profile for other blade radii.*
This method permits in the same time to find the optimal profile, using the multitude of the profile characteristics, experimentally studied.

Keywords: Screw performances optimization, Mud agitator, Mud agitator screw, Bio fluids

1. The importance of the optimisation methods on posed problem

The problem of the bio liquid velocity minimisation, to not harm the growth biologic process of the bacteria existent in the organic mud, may be extracted from the axial F_a or peripheral F_u force, how and from the consumed mechanical power P_m at the agitator shaft and it is very important not only concerning the energy saving, but also for the environmental protection [1].

2. The primary equations, which intervene in this problem

Starting from the classical theory and practice of the airfoil placed as in figure 1, we have the following relations for the lift and drag component of resultant force:

$$F_y = C_y(i)\frac{\rho}{2}W^2 b\, l(R) \quad \text{and} \quad F_x = C_x(i)\frac{\rho}{2}W^2 b\, l(R) \tag{1}$$

Projecting these forces, for example in the case of the blade peripheral profile, both on the axial direction and on the peripheral direction of the profile motion we can write the expressions of axial or peripheral force exerted on the rotor blades.

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