experimental laboratory of the Michurinsky Garden laboratory of the Russian State Autonomous Agricultural University named after K.A. Timiryazev.

Raspberry drip irrigation will be carried out with the help of droppers located along the length of the pipeline at a distance of 0.3 m. Monitoring of soil moisture is planned to be carried out by thermostat-weight method. The experiments will be accompanied by phenological observations, harvesting, analysis of soil and plant samples.

Expected results:

1. The development of drip wetting regimes of raspberries on sod-podzolic soils of the Moscow region.

2. Definitions of the relationship between raspberry water consumption and the total influx of solar radiation, the sum of active temperatures and humidity of the active soil layer.

3. Identification of the positive impact of drip irrigation regimes on the growth, development, productivity of raspberry and its quality.

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PROSPECTS FOR THE USE OF ARTIFICIAL ROUGHNESS AS FLOW ENERGY DISSIPATORS ON THE SPILLWAY SURFACE OF A LOW-HEAD CONCRETE DAM

Kanyarugendo Leonidas, *PhD student of the Department of Hydraulic Engineering Structures, Russian Timiryazev State Agrarian University, kany.l@mail.ru*
Aleksei Yu. Alipichev, *PhD (Ed), Associate Professor of the Department of Russian and Foreign Languages, Russian Timiryazev State Agrarian University, alipichev@rgau-msha.ru*

Abstract*: The paper describes various design models and the application of artificial roughness as a flow energy dissipator for solving various technical tasks in hydraulic engineering. It also justifies hypothesis of possible strengthened roughness efficiency on the spillway surface of a low head concrete dam.*

Keywords*: artificial roughness, high-velocity channels, energy dissipators.*

The regulation of flow parameters on artificial stream beds or when a stream transits from hydraulic structures to natural river beds has always been for interest in hydraulic engineering. The flow parameters in open channels must be adjusted for the safe operation of the structures themselves, to maintain the ecological state within acceptable limits and to provide their required technical conditions depending on their purpose.

There are various technologies for regulating the hydrodynamic parameters of the flow, depending on the design features and operating conditions of the structures. Artificial roughness is widely used in fast currents, fish passages and a number of other engineering culverts, where it is impractical or structurally impossible to reduce the water flow velocity to acceptable limits by simple reducing the slope of the culvert.

In 2012, of a professor at National Technical University of Athens, School of Civil Engineering (Greece) George C. Christodoulou made an experiment on some types of roughness elements. Basing on obtained experimental results for flow in a 16.5% sloping channel over various kinds of submerged artificial large scale roughness elements, he provides their classification according to the efficiency in reducing the flow velocity in the channel. According to his results, and as mentioned of figure 1, "*the highest resistance is offered by the angles (essentially plates), followed closely by the baffle blocks and cubes. Elements with smaller height* [….half-cubes] *yield significantly smaller values of* $\boldsymbol{n_b}$ [the Manning coefficient]. *The elements with rounded edges result in smaller* $\boldsymbol{n_b}$ *values compared to similar sized ones with sharp edges. Thus the resistance of cylinders and of hemispheres normal to the flow with same height and projected area as the cubes, baffle blocks and angles is considerably lower. Similarly the value of* $\boldsymbol{n_b}$ *for the hemispheres parallel to the flow is appreciably lower compared to the half-cubes"* [1].

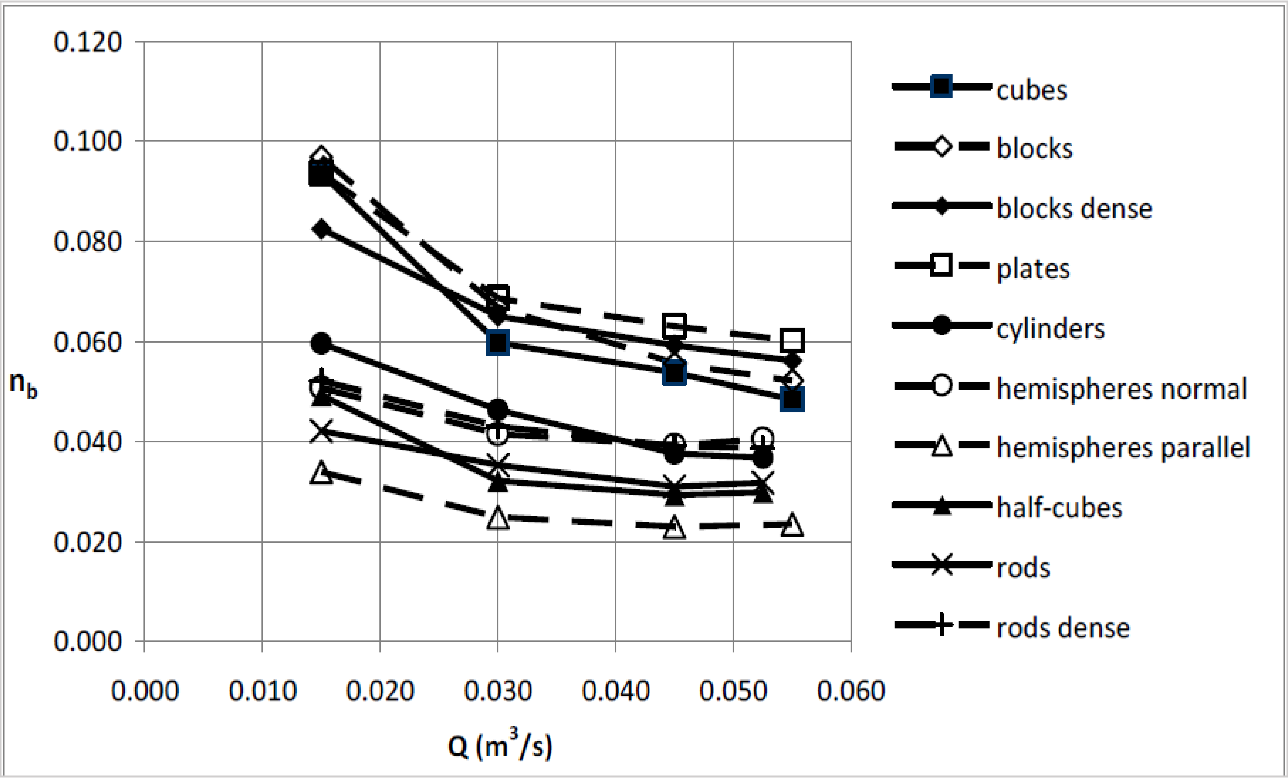


Fig. 1. **Relationship between coefficient *n* and the type of roughness elements**

Also, Yu. M. Kosichenko, V.N. Shkura and O. A. Baev in the development of methods for hydraulic calculation of fish passage and spawning channels showed a significant increase in the Manning coefficient ***n*** due to roughness elements, which leads to a decrease in the flow rate in the considered channel [2]

$$\mathbf{n_{ш}} = \mathbf{n_{пр}} \cdot \sqrt{\mathbf{1} + \frac{\mathbf{R_{к}^{4/3}}}{\mathbf{2gn_{пр}^{2}}} \cdot C_{\mathbf{d}} \cdot \overline{\mathbf{d_e}} \cdot \overline{\mathbf{h_{ш}}} \cdot \mathbf{N}},$$

where is the Manning roughness coefficient of the channel, taking into account the elements of artificial roughness;

$\mathbf{n_{пр}}$ – channel roughness coefficient, excluding elements of artificial roughness,

$\overline{d_e} = \sqrt{\frac{4a^2}{\pi}}$ is the average diameter of the circular element equivalent to a cube,

a – is the linear dimension of one side of the cuboid roughness,

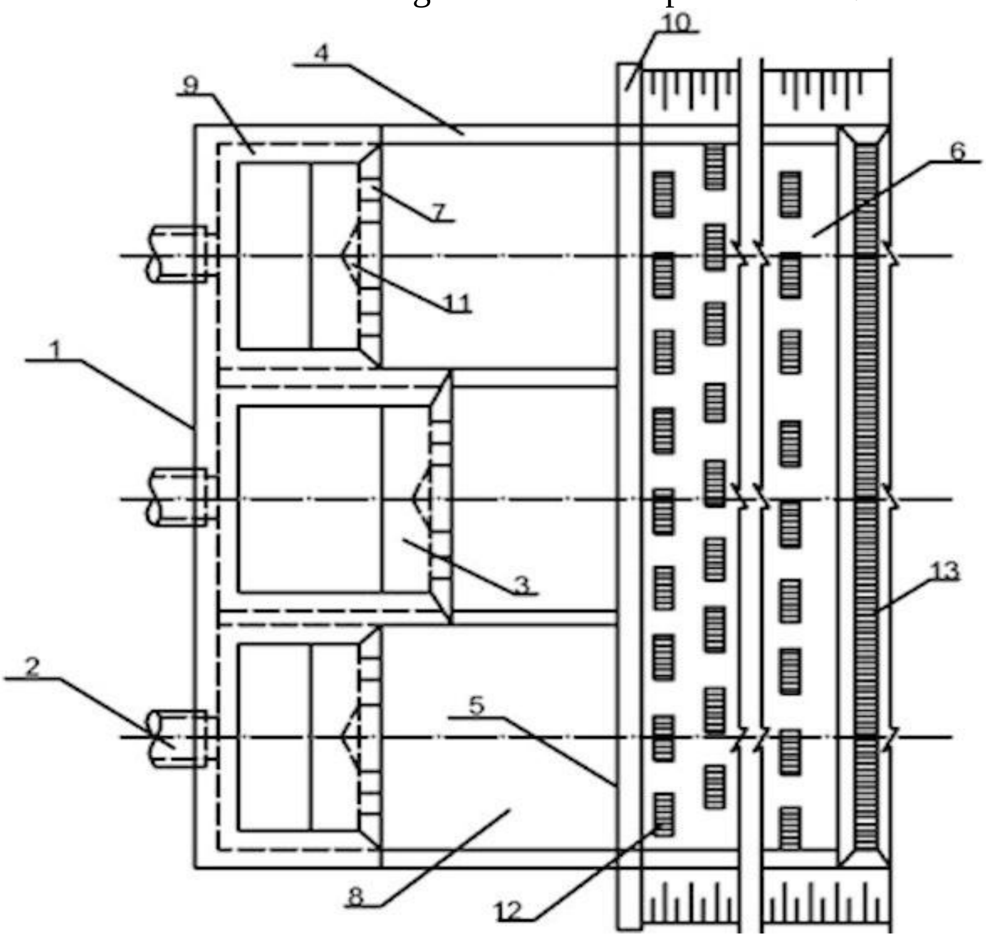
– drag coefficient of the element $(C_d$ = 0.4 ... 0.5),

N –the number of roughness elements per unit area,

$\overline{\mathbf{h_{ш}}}$ – average height of the wetted part of the roughness element,

$\mathbf{R_k}$ – hydraulic radius,

N – the number of roughness elements per unit area.



1-end wall
2-pipe
3- boom
4-side wall
5-end sill
6-channel
7-neckline
8-bottom
9- visor,
10-opener
11-lower visor
12- roughness element
13- apron sill

Fig. 2. **Multi-section dissipator design with roughness elements and an apron sill**

The example of calculation [2] using cubic roughness elements of size 0.3m *x* 0.3m *x* 0.3m allows to achieve a decrease in water flow velocity by about 36% with as initial data Q = 100m^3/s, slope i = 0.0005 and channel width b_k = 36m and channel side slope m = 3,5

Elements of artificial roughness also turned out to be effective in water flow energy dissipation while used in the downstream end part of a multi-section dissipator (Figure 2) [3]. From the point of view of hydraulic working conditions, they led to the Coriolis coefficient $\alpha = 1.0 \div 1.2$ in comparison with the models of the first series of studies, without elements of artificial roughness [3], where the values $\alpha = 1 \div 1.5$. By reducing the range of the Coriolis coefficient is meant approaching a more uniform flow velocity distribution.

Reinforced roughness is currently widely used while dissipating flow energy. It is most often arranged in the form of transverse bottom ribs at the bottom, and sometimes on the side walls of the channel, and methods for its calculation have already been developed, especially for relatively small slopes of high-velocity channels for various purposes [4]. Its energy dissipation efficiency is no longer in doubt.

Hypothesis about the possible artificial roughness efficiency on the downstream surface of a low-head concrete dam spillway is based on close hydrodynamic principles of operation of such hydraulic structures and high-velocity channels, as well as on the already approved high efficiency of artificial roughness to increase flow resistance.

Moreover, it is worth paying attention to the difference between the slopes of the spillway concrete dams and the slopes of channels or fast currents. For example, according to [4], it is specified that *"the calculation of the ribbed channel bottom with roughness elements of a square section ($\Delta \times \Delta$) with the distances between the axis of the ribs $\delta = 8\Delta$ and for slopes $\boldsymbol{i_{cr}} < \boldsymbol{i_0} < \mathbf{0.6}$ is performed according to the method of O.M. Ayvazyan [Russian: O.M. Айвазян] "; where* $\boldsymbol{i_{cr}}$ and $\boldsymbol{i_0}$ are respectively channel critical and current slopes. It is unlikely that the slope of the side of the spillway, erected according to the coordinates of Krieger-Ofitserov, falls into this interval of slope. This lead to doubt that out of this slope interval, their effect should be different.

However, there are other calculation methods that do not limit the interval of this indicator, designed to analyze the high-velocity channels.

The high inclination of the spillway face compared to high-velocity channels and channels prevents from making assertion that artificial roughness on its face will lead to the same effective results of energy dissipation, without additional experimental justification. This hypothesis has to be experimentally verified from the point of view of efficiency, reliability and economic feasibility in comparison with the existing approaches to solving hydrodynamic issues in dam engineering.

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HERSTELLUNG VON ORIGINALGETRÄNKEN AUF DER GRUNDLAGE VON ZICHORIEN

Karpova N.A., *Aspirantin des ersten Studienjahres der technologischen Fakultät der Russischen Staatlichen Agraruniversität – Timirjasew-Akademie Moskau, natti94@mail.ru*
Ljamina I.M., *Hochschullehrerin des Lehrstuhls für Fremdsprachen und Russisch der Russischen Staatlichen Agraruniversität – Timirjasew-Akademie Moskau, lira2005@list.ru*

Annotation: *Um die Möglichkeit der Verwendung von Destillaten auf Zichorie -Basis für die Zubereitung von Originalgetränken zu bewerten, wurden Wurzel-Zichorie-Studien durchgeführt. Während der Forschung wurden die chemische Zusammensetzung von Zichorienwurzelkulturen sowie die Modi und Indikatoren der technologischen Verarbeitung von Rohstoffen und die Zusammensetzung von Destillatverunreinigungen untersucht. Eine Zwischenbewertung der Verwendung von Zichorie-Schlempe als organischer Dünger wurde durchgeführt.*

Schlüsselwörter: *Zichorienwurzel, Inulin, Ethanol, Destillat, Barda.*

Hauptrohstoff für die Alkoholproduktion sind verschiedene Arten von pflanzlich kohlenhydrathaltigen Rohstoffen, deren Kohlenhydrate sowohl durch einfache Zucker (Mono und Disachariden) als auch durch Polysachariden dargestellt werden. Alkohol-Hefe können einfache Zucker schnüren, so dass Polysachariden