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DEPTH EROSION OF TECHNOGENIC LOADED LOESS SLOPES

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Abstract. Complement series of loess soils was carried out to identify a mechanism of the soil restructuring in the process of filtration and to demonstrate qualitative nature of gravel and sludge evacuation as well as its metamorphosis under various conditions. The experiments, concerning filtration movement of water in a device of triaxial compression, make it possible to evaluate structure changes taking place during the process; besides, a method of erosion forming is identified. Identify prognostic boundaries for transformation of suffusion processes into erosion ones.

Keywords: loess soil, filtration inversion, erosion, triaxial compression.

ГЛУБИННАЯ ЭРОЗИЯ ТЕХНОГЕННО НАГРУЖЕННЫХ ЛЕССОВЫХ СКЛОНОВ

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Аннотация. Проведена серия испытаний лессовых пород с целью установления механизма протекания перестройки структуры породы при фильтрации, а также для представления количественного характера процесса выноса грунтового материала и его изменениях в различных условиях. На основании экспериментальных исследований фильтрационного движения воды в приборе трехосного сжатия оценены изменения структуры, происходящие при этом, а также установлен механизм образования эрозионных промоин в образцах. Установлены прогнозные границы перехода суффозионных процессов в эрозионные.

Ключевые слова: лессовые породы, фильтрационная инверсия, эрозия, трехосные испытания.

In paper [1] we evaluate changes taking place in loess in the process of its saturation and technogenic underflow filtration. Experimental results obtained in a device of triaxial compression TriSCAN (VJTech, Great Britain) helped to establish the inversion of loess filtration anisotropy in comparison with its natural occurrence. If radial load is $\sigma_3 = 300$ kPa, then suffusion, passing into erosion with preceding phase of hydraulically inert cavities formation, is observed. On the assumption on the results, complement series of loess rocks was carried out to identify a mechanism of the rock restructuring in the process of filtration and to demonstrate qualitative nature of gravel and sludge evacuation as well as its metamorphosis under various conditions. Moreover, grain size measurements were performed for the rock and for evacuated material.

Similarly to [1], adown and surface-perpendicular to surface formation effect of filtration flow on soil was analyzed; however, the emphasis is upon the filtration formed in parallel to stratum. Samples of loess of quaternary from such Dnipropetrovs'k gulches as Tonnelna and Topolyna were tested under the conditions of triaxial compression. To correct load ranges for erosion forming, 250-300-350 kPa geostatic pressure was applied. Pressure gradient in the sample was 20 kPa corresponding to actual conditions of the soil mass.

First series of tests met the requirements of adown filtration technique. Suffusion with small share of evacuated particles and the greatest activity during first hours after filtration has started (4-5 hours) takes place. Certain impulses of the material evacuation fall at a period of up 2 hours; then the evacuation minimizes, and dying period is 12 hours to be in accordance with the sample gradual restructuring. No deformations, flaws, cavities, and visible dislodgements showed following visual inspection of tested samples.

Results obtained while using the tests, carried out in parallel to stratum, are much different.

For all samples tested at $\sigma_3 = 300$ kPa, and one sample tested at $\sigma_3 = 250$ kPa, erosion formation was visually documented; the erosion exposes after 6-8 hours after filtration process has started. The quantity of particles exposing in the period of the test has been documented; granulometric analysis (according to Sabanin) of both original and evacuated rock material has been carried out (Fig. 1). Fig. 2 demonstrates visible changes in the samples.

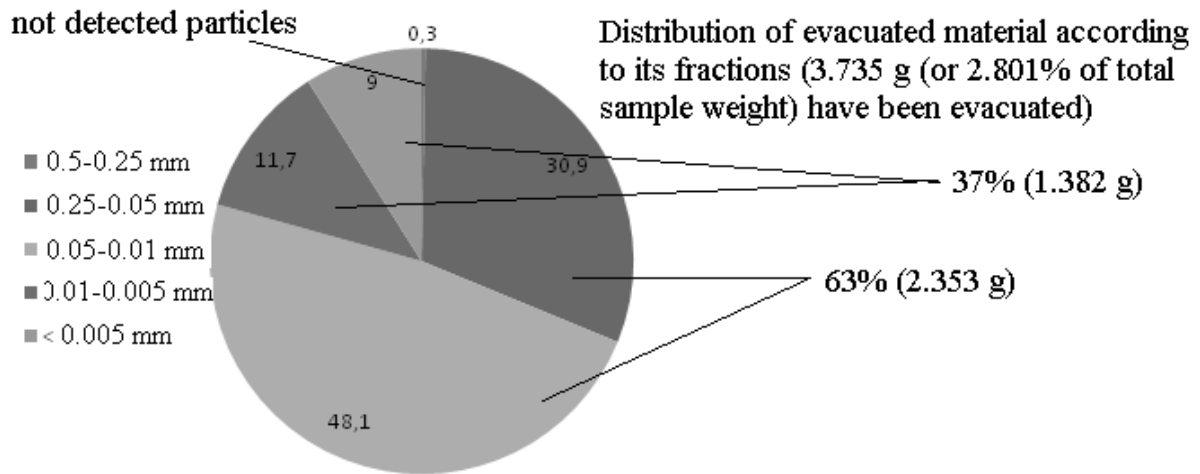


Figure 1 – Averaged results of granulometric analysis of covered loess in the process of suffusion

The most intensive process of the particles evacuation (72% of total mass) took place from 2.5 to 6.0 hours in terms of the filtration start. Fig. 2 demonstrates that in the majority of cases the period takes noticeable changes in the sample volumetric deformation values.



Figure 2 – Erosion in loess samples for filtration technique taking place in parallel with stratum

In accordance with granulometric ratio of coming out particles, periodicity and changes in volumetric deformations one may conclude that in considered loess, soil congeries removal takes place rather than separate particle removal. Just at initial stages of filtration the evacuation of relatively identical soil fraction took place; subsequently, fractional evacuating composition coincides with total one. Hence, if only separate particles release was involved, then the struc-

ture experienced its transformation forming dislodgement zone rather than erosion cavity.

Analysis of the results concerning changes in volumetric deformations, the qualitative ranges of removed particles as well as visual observations makes it possible to identify prognostic zone of suffusion transformation into the first erosion stage and formation of closed channel with inert drain surface (Fig. 3).

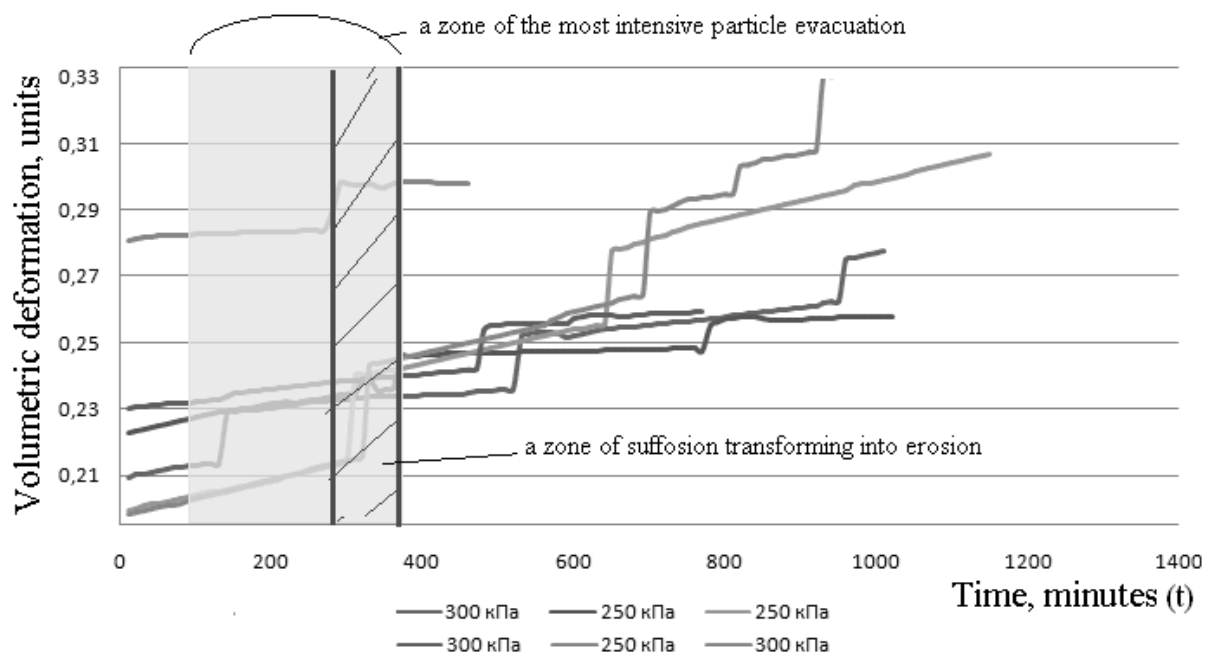


Figure 3 – Generalized results of loess tests in parallel to stratum:
250 and 300 kPa are load ranges

Conclusions. The experiments, concerning filtration movement of water in a device of triaxial compression, make it possible to evaluate structure changes taking place during the process; besides, a method of erosion forming is identified. Erosion can not be formed in the process of vertical filtration; if filtration in parallel to stratum takes place are applied to identify prognostic boundaries for transformation of suffusion processes into erosion ones. Average values of particle removal as well as their granulometric composition for the Dnieper region loess soil (2.801% of the sample weight) have been obtained. The research is the basis to prognosticate so-called liquefaction slides being a result of technogenic filtration load of slopes.

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ОБРОБКА АЛЮМІНІЄВИХ РОЗПЛАВІВ ПЛАЗМОВИМ СТРУМЕНЕМ

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Анотація. Визначені енергетичні параметри заглибленого у метал плазмового газового струменя, досліджено фізико-хімічні та масообмінні процеси в розплаві при обробці його газореагентним середовищами.

Ключові слова: метал, плазмотрон, сплав, рафінування, плазмовий струмінь.

PROCESSING OF ALUMINUM MELT OF PLASMA JETS

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Abstract. The identified energy parameters absorbed in metal plasma gas jet investigated physico-chemical and mass transfer processes in the melt when processing it environments.

Keywords: metal, plasma torch, alloy refining, the plasma jet.

Вступ. Неможливість ефективної обробки всього об'єму рідкого металу у багатотонному агрегаті призвела до необхідності безперервного процесу позапічного рафінування розплаву у невеликих установках. Разом з цим безперервність процесу накладає додаткові вимоги на організацію масопереносу газів і шкідливих домішок із розплаву у рафінуючу фазу. Це