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Transporting irrigation systems and problems of their tightness

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Abstract: This paper considers the improvement of the known waterproofing composition in order to provide a technological advantage in the production of the material in the field conditions.

Key words: *corrosion protection, crack resistance, tensile strength, water absorption, adhesion, economic effect.*

As long-term domestic and international practice of construction and operation of conveying land reclamation systems shows, the problem of their imperviousness efficiency is acute. There is an opinion of the majority of specialists that even under strict control and supervision over fulfillment of sealing works both at the stage of construction and intermediate repair and rehabilitation measures, water resources losses can reach 50 and more percent from main and on-farm networks during their transportation. It follows that more than half of valuable for arid zones, to which Uzbekistan belongs, is lost irretrievably to filtration, replenishing groundwater, contributing to waterlogging of some areas, negatively impacting the ecological situation as a whole. If we take a closer look at this problem of unjustified involuntary water losses, the reason is not only a large number of joints in the structures of impervious concrete covers of canals but also inefficiency of materials used for their compaction.

In this regard, in this paper, we consider options for technical solutions to compare methods and materials for sealing the joints of transportation systems of various types with an assessment of the economic characteristics of the solutions. Thus, as an example, let's consider a variant of cost indicators of joints sealing with sealants of various types.

Table 1. Cost of sealing the joints of flume water conduits LR-60 with different sealants and their operational reliability.

№	Type of sealant and its brand	Tensile strength, kgf/cm^2	Stretching, %	Consumption of the main product per 1 seam, kg.	Cost of sealing of 1 joint, thous.	Cost of joints per 1 km, mln.	Possibl e seal life, years
1	Thiokol KB-05 TU 39-3-339-68	3	170	0,2	8,6	1,428	7-8
2	-//- TM-1, HS-1	5-7	100-180	0,2	8,4	1,395	6-7
3	Butyl rubber CPL-2	1-4	150-200	0,2	4,2		

4	-/- BGM-1	6,0	100-200	0,2	3,6	0,601	5-7
5	Organosilicon elastosil 2	16	140	0,2	19,2	3,840	4-6
6	Epoxidised PDNZAK oligomers TU 38-4031-70	24-38	85-370	0,2	10,4	1,737	7-8
7	Fluorocarbon 14 NFZ TU 38-4055-71	20-30	200	0,2	21,2	3,541	6-8
8	Polyisobutylene UMS-40 GOST 14701-70	0,1	300-350	0,2	2,0	0,334	1,5-2
9	Bituminous rubber BITEP	0,3-0,4	200-300	0,2	10,8	1,804	6-7
10	Porosol CSRZ	5-5,5	110	0,7	2,8	0,468	1-2

The above cost values in Table 1 are given without considering all cost elements and at the lowest possible joint width. Taking into account all total costs and the joint widths most likely in practice, the annual cost of joint compaction for small capacity waterways can be the following values given in Table 2.

Table 2. Cost of annual costs for sealing the joints of the trays LR-60 of all associated costs taking into account the durability of the seals and the width of the joints 20 mm.

№	Type of sealant	Cost of sealant for 1 joint thousand soums	Cost of poroisol, thousand soums	Labour costs, thousand soums	Total costs, thous and soum s	Annual cost including durability, thousand soums/ year	Total annual cost per 1 km of joints
1	Thiokol Kb-05	17,2	5,8	5,2	28,0	4,0	668000
2	Butyl rubber CPL-2	8,4	5,8	5,2	19,4	3,23	539000
3	Organosilicon elastosil 2	38,4	5,8	5,2	49,4	8,23	1374400
4	WAC HDPE oligomers	20,8	5,8	5,2	29,8	4,26	711400
5	Fluorocarbon 14 NFZ	21,2	5,8	3,2	30,2	4,31	7198100
6	Polyisobutylene UMS-40	4,0	5,8	3,2	13,0	6,5	10855000
7	Bituminous-polymer BITEP	21,0	5,8	3,2	30,0	4,29	716430
8	Porosol CSRZ	5,6	5,8	3,2	14,6	7,3	1219100
9	Bitumen-nairite compositions	21,0	5,8	3,2	30,0	2,0	334000
	BOC [1]						
10	BSR compositions	19,0	5,8	3,2	28,0	1,75	292250

The analysis of the above tables shows rather high costs of sealing, even when sealing small flume conduits. When performing works in prefabricated reinforced concrete canals with the capacity of similar flume conduits, the cost of sealing can increase at least 3-4 times due to the use of small-size elements. The cost of sealing costs can also increase significantly above these values due to the durability of the joint, as the viability of the joint largely depends not only on the material, but also largely on the competence of the master-sealer, as the production technology is quite complex and requires long experience, contributing to the greatest contact of the material to the jointed elements.

Thus, given the above, we can conclude that, in many respects, the significant loss of water resources noted by experts from conveying systems can also be observed due to the high cost of the use of low-quality materials and the inexperience of the master sealant.

Another facet of the problem of insufficient imperviousness of conveyance systems is the lack of any acceptable compositions on the market, forcing agricultural producers to use non-conforming materials to reduce water losses.

Taking this into account, specialists of Research Institute of Water Problems have developed compositions of cold bituminous-polymeric compositions based on technologies acceptable for farms that can sufficiently solve the problem of impermeability of irrigation structures with provision of quality and long term viability of joints.

The following components are required for the preparation of the cold composition shown in Table 3.

Table 3: Components of compositions

№	Component name	1 composition	2 composition
1	Liquid rubber Nairit grade A, g	1000,0	1000,0
2	Cerezin, gr.	25,0	25,,0
3	Cerezin, gr.	3,0	3,0
4	Tiuram, gr.	0,5	0,5
5	Epoxy resin ED-20, gr.	15,0	60,0
6	Hardener, AF, g.	1,5	6,0
7	Vulcanizer (zinc and sulfur oxide), g	25,0	25,0
8	Bitumen road BND 40/60, gr.	2000,0	2000,0
9	Solvent (toluene, xylene, solvent, P- 646), g	2000,0	2000,0
Total of one substance, g		3095,0	3120,0

The first composition is recommended for use in spring and summer period when treating concrete.

The second composition is recommended for use in the autumn-winter period with the expectation of cold weather, as well as in the case of treatment of both concrete and metal.

Ready compositions after their application to the structures and vulcanization provide the following properties of physical-mechanical and operational-technical properties in the process of operation.

Table 4: Basic properties of formulations.

№	Basic properties of compositions during operation	Property values
1	Water absorption after 2 years in water	2,5-2,52
2	Water resistance coefficient. Water resistance after 150 days of operation in water	1,03-1,10
3	Strength at storage in air for 150 days, MPa	0,1-0,25
4	Stretchability in water 150 days, not less, %	1200-870
5	Coefficient. Tensile strength water resistance	1,03-1,08
6	Water resistance according to stretch coefficient	0,89-1,03
7	Water resistance coefficient for adhesion to concrete	1,07-1,11
8	Water resistance coefficient for adhesion to steel	1,3-1,75
9	Specific volumetric electrical resistance after 1.5 years in water (VSWR)	10^{11} -10^{12}
10	Crack resistance after 250 cycles of freezing and thawing	3,0-3,4

Thus, as it can be seen from the presented tables, the developed compositions provide stability of the basic properties and sufficient characteristics of physical-mechanical and operational indicators.

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