МЕНЕДЖМЕНТ

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ECOMANAGEMENT OF PIPELINE TRANSPORT AS FACTOR OF ECONOMICS ECOLOGIZATION

Urgency of the research. *Pipeline transport (PT) in Ukraine is a basic bar of the oil-and-gas complex of country, guarantee of its energetic safety. It is explained by very important role of the oil-and-gas transport system in the economy of Ukraine.*

Target setting. *Therefore it is necessary to develop the scientific-methodological foundations of ecomanagement of the PT on increasing its technogenous-ecological safety level as the efficient factor of economics greening.*

Actual scientific researches and issues analysis. *For the analyzed works O. M. Adamenko, S. I. Doroguntsova, L. G. Melnika, G. I. Rudko, V. M. Schmandija, D. R. Baer, R. D. Cane a.o. appear a limitness of the date on the theoretical and methodological foundations and the scientific principles of the formation of ecological-economical safety of the PT, the prevention of the risks of technogenous accidents with the high economical and ecological damages.*

Uninvestigated parts of general matters defining. *The scientists have not jet sufficiently developed questions of the integrated estimation and prediction of the technogenous influence on the ecological-economical safety of the PT and its prevention.*

The research objective. *The aim and tasks of the work – to develop the scientific principles of solving the problem of providing and managing of the ecological-economic safety of the PT by improving the technological processes on the base of the integrated estimation of the eco-desctructive technogenous influence on the PT.*

The statement of basic materials. *The article proves the expendiency of an improving of the technological processes, with the high technical-economical and social-ecological efficiency, for the security of the ecological-economical safety (the innovating resource and energy-saving technologies of welding, the synergist protection compositions on the secondary raw materials etc.). The models of complex ecomanagement, monitoring, with receiving the positive synergist ecological-economical effect (PSEE) are developed.*

Conclusions: *it is showed, that the greeneng of economics, the balanced natural using: a prevention of the man-made disasters, the elimination of losses of energetic materials, unreceived products, a compensating expenses on a liquidation of the consequences of technogenous accidents is provided by the improvement of ecomanagement of the technological processes.*

Keywords: *ecological-economical safety of pipeline transport; ecomanagement; improving of techprocesses; technoeconomical; socio-ecological efficiency.*

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ЕКОМЕНЕДЖМЕНТ ТРУБОПРОВІДНОГО ТРАНСПОРТУ ЯК ЧИННИК ЕКОЛОГІЗАЦІЇ ЕКОНОМІКИ

Актуальність теми дослідження. *Трубопровідний транспорт України є основним стрижнем нафтогазового комплексу країни, гарантом її енергетичної безпеки. Це пояснюється надзвичайно важливою роллю нафтогазотраспортної системи в економіці України.*

Постановка проблеми. *Отже, виникає необхідність розробки науково-методологічних засад екоменеджменту трубопровідного транспорту по підвищенню рівня його техногенного-екологічної безпеки як ефективного чинника екологізації економіки.*

Аналіз останніх досліджень і публікацій. *Із проаналізованих робіт О. М. Адаменка, С. І. Дорогунцова, Л. Г. Мельника, Г. І. Рудька, В.М. Шмандія, D. R. Baer, R. D. Cane та ін. слідує обмеженість даних про теоретичні та методологічні основи, наукові принципи формування екологічної безпеки ТРТ, запобігання ризику техногенних аварій з високими економічними та екологічними збитками.*

Виділення недосліджених частин загальної проблеми. *Науковцями ще недостатньо опрацьовані питання щодо комплексної оцінки та прогнозування техногенного впливу на еколого-економічну безпеку ТРТ та його попередження.*

Постановка завдання. *Мета і задачі роботи – на основі комплексної оцінки екодеструктивного техногенного впливу на ТРТ, розробити наукові засади вирішення проблеми забезпечення та управління його еколого-економічною безпекою удосконаленням технологічних процесів.*

Виклад основного матеріалу. *У статті, для забезпечення еколого-економічної безпеки ТРТ, обґрунтовується доцільність удосконалення технологічних процесів з високою техніко-економічною, соціально-екологічною ефективністю (інноваційні ресурсо- та енергозберігаючі технології зварювання, синергічні захисні композиції на вторинній сировині та ін.). Розроблені моделі комплексного екоменеджменту, моніторингу, з одержанням позитивного синергічного еколого-економічного ефекту (ПСЕЕ).*

Висновки. *Показано, що удосконаленням екоменеджменту техпроцесів забезпечується екологізація економіки, збалансоване природокористування:запобігання техногенних аварій ТРТ, скасування втрат енергетичної сировини, недоодержаного продукту, компенсаційних затрат на ліквідацію наслідків техногенних аварій.*

Ключові слова: *еколого-економічна безпека трубопровідного транспорту; екоменеджмент; удосконалення техпроцесів; техніко-економічна; соціально-екологічна ефективність.*

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Urgency of the research. The level of operational reliability, environmental safety and economic security, the lack of industrial accidents are the main indicators of the efficiency of the pipeline transport (PT). According to U.N.O. the risk of industrial accidents (pollution of freshwater, marine water, air, soil), land degradation (due to the accumulation of toxic chemicals, waste) are the most threatening environmental and economic issues at the global level.

Target setting. Ecological and economic danger on PT is mostly created by the environmental situation, which is based on eco-destructive processes: chemical (accumulation of toxic substances in the environment, including heavy metals (HM)), physical (activating effect of energy pollution) and biological (effect of aerobic, anaerobic bacteria). These negative processes cause eco-destructive devastating effects: surface and volume effects in pipe steels in technogenic systems cause dangerous destruction due to cracking and fatigue. This is the main reason of technogenic disasters and ecological-economic danger on PT in 80% of cases. Man-made accident at PT cause significant ecological and economic losses due to lost, underproduced products, compensation of losses in the aftermath of industrial accidents, destruction of natural landscapes, HM accumulation in flora, fauna and through food chains - in human body. This makes the urgent need for eco-managing measures to stabilize and improve the environment for new integrated approaches identifying and predicting levels of eco-destructive anthropogenic influence (ingredient, energy) on the ecological state of technogene systems with PT.

Actual scientific researches and issues analysis. Sources [1; 2] refer to the enterprises of man-made high risk as the sources of the conflicts in Ukraine. The PT are considered as ecologically hazardous enterprises. The authors [3] draw attention to the need for a comprehensive assessment of the impact of anthropogenic pollution on the environment. In source [4] the high level of environmental dangers of man-made pollution with heavy metals (HM) as super-toxic materials of XXI century is emphasized. In [5; 6] the significant ecological and economic losses due to anthropogenic impact crashes are shown. These are losses of business entities from violation of the environment, damages and additional costs spent on preventing them. Only at air pollution the environmental and economic damages on lost, underproduced products and compensation costs are, respectively, 10, 40, 50% of ecological and economic damage [5; 6]. Consequently, emergency pollution of air, water and land resources causes damage thousand UAH., respectively: 2.5, 29, 71 [6]. In a market economy technogenic pollution affects the main technical and economic indicators of the business - production costs, profits. The material, labor and energy resources are being lost, the capital productivity and virtually all indicators of business activity of manufacturing entities are being reduced. The authors of [7] suggest the analysis of the formation and management of ecological safety. Works [8; 9] refer to the management of environmental safety and economy disasters. Work [10] is dedicated to the issue of environmental safety of PT.

Uninvestigated parts of general matters defining. Scientists have not worked (research) The questions concerning economic complex estimation of anthropogenic impact on PT and ways to ensure its environmental and economic security as an effective factor in greening the economy has not been worked out by the scholars yet.

The research objective. The aim and tasks of the work are to develop the scientific principles of solving the problem of provision and managing the ecological-economical safety of the PT by improving the technological processes on the base of the integrated estimation of the eco-destructive industrial influence on the PT

The statement of basic materials

1. Methodical and methodological aspects

To solve the tasks set in the work the systematic approach is involved decomposing the technogene ecosystems with PT into hierarchical sub-systems:

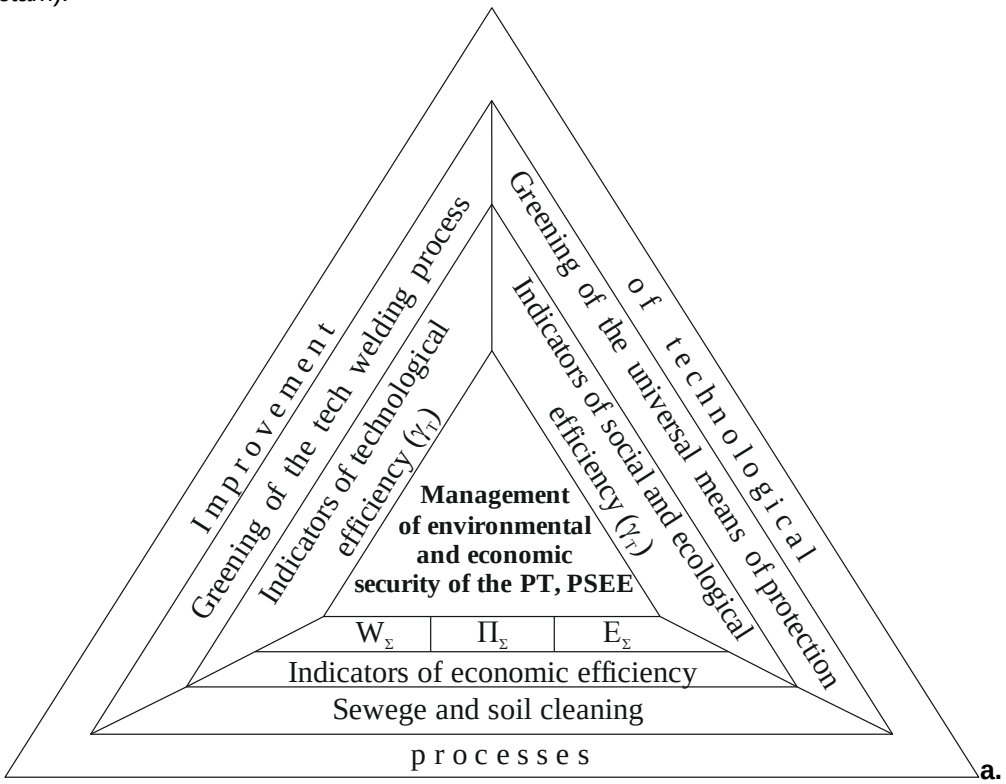
- ecomanagement (EM) under conditions of anthropogenic influence (ingredient and energy pollution), by a unified complex scoring [11], with the establishment of the sum dangers indicator I_D (0 ... 100) for 10 components and eco-state (from favorable, normal (1, 2 points) to crisis, catastrophic (9, 10 points)).

- management of environmental and economic security of the PT, improvement of technological processes by their technical-economical and socio-ecological efficiency. Attaining the positive synergistic environmental and economic effect (PSEE) using synergistic protective compositions of secondary raw materials is shown by the example of one of the most important technological processes for all industries, especially for pipeline oil and gas sector – welding. [11; 12] (Fig. 1).

2. Results and discussion

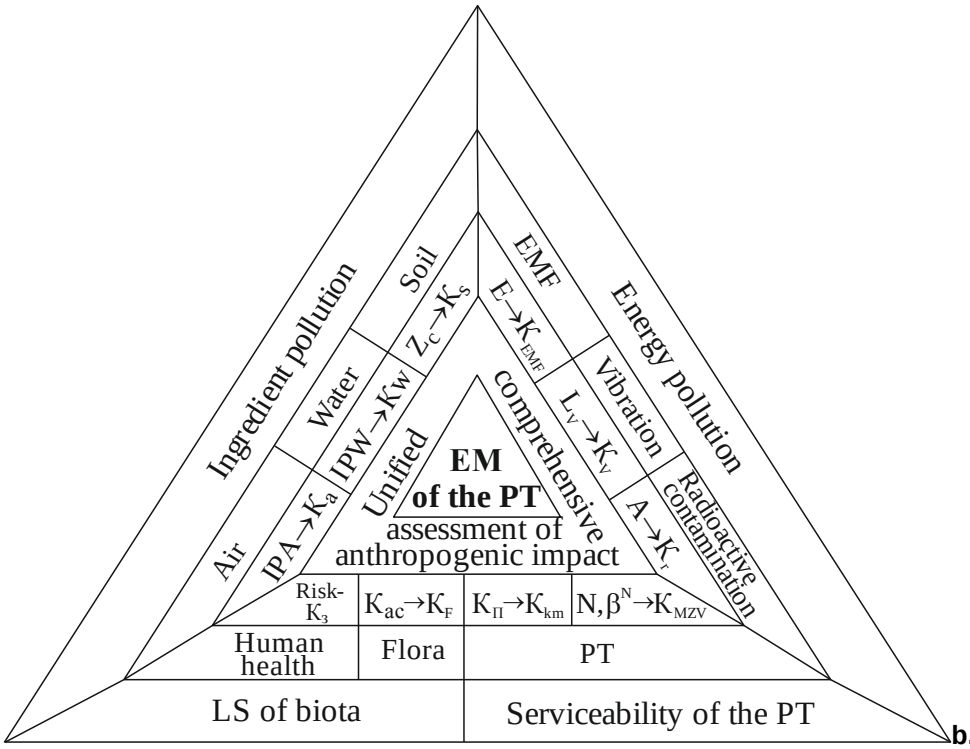
The choice of innovative technology of welding low-alloyed pipe steels (automatic arc welding (AAW) under the flux layer, instead of manual arc welding (MAW)) significantly reduces (by more than 20 times) technogenic pollution caused by welding aerosol, oxides of heavy metals (Cr, Ni, Fe, etc.) - up to 40 times. Soil contamination decreases in 14…18 times by Z_C: category of extremely dangerous pollution (IV) turns into permissible (I) – according to State standarts 2.2.7.029-99 "Soil Protection" and State Standard ISO 10381-1: 2004. The most efficient steel welding 16SAW with volumetric thermosolidifying (VTS) enhances the improvement of ecological-economical safety of welding for C_p, technological efficiency ratio γ_T is 5.1 in the soil polluted by HM, with Z_C=68. It means that the welding junction (WJ) turns from group 4 “lowered stable” into stable (group 3). The endurance of WJ of steel is also provided in sewage and surface water: γ_T=2.2…2.9, especially in the most vulnerable area of WJ - heat-affected zone (HAZ), which is, together with welded seam (WS) responsible for destructions and man-made disasters on the PT (Fig. 2). The improvement of the technological process of steel welding 16SAW (with VTS) is provided by increasing its stability when exposed to EMF (f=100 kHz, E=100 V/m, H=5 A/m), γ_T=2.

To develop synergistic protective compositions (SPC) secondary raw materials were used with the recycling of the regional waste (C – cubic departure of the first distillation of caprolactam in regeneration shop ε-caprolactam).



a.

a: the indicators of the ingredient pollution of BM (air, water, soil – K_a, K_W, K_S according to the indexes of pollution IPA, IPW, the total figure of soil pollution – Z_C); energy pollution– K_{EMF}, for E (V/m), vibration K_V, за L_V (dB), radiation – K_r, for A (Ku/km^2).



b.

b: managing environmental and economic security of the PT by introduction of innovative energy saving technologies to produce PSEE, by the technical and economic, social and environmental efficiency, based on differentiated assessment, including economy, achieved by the elimination of environmental damage $W_\Sigma=W_a+W_W+W_S$, environmental tax $\Pi_\Sigma=\Pi_{VS}+\Pi_S+\Pi_r$, and total economic effect $E_\Sigma=\sum_{i=1}^{n=7} E_i$. E_Σ is formed by: elimination Π_Σ – E_1, of the transport expenses– E_2, and the cost of the waste dumps – E_3, profit from sales of waste – E_4, E_5 – the difference in prices for secondary raw materials; the abolition of risk of industrial accidents – E_6, and the cost of compensation for excess air water, soil, plants pollution, landscapes abuse, deterioration of the health.

Fig. 1. Models of complex eco-management EM (a) and management of environmental and economic security of the PT obtaining PSEE (b)

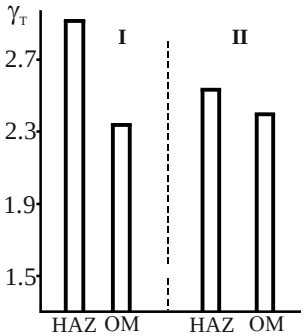


Fig. 2. γ_T innovative technology of steel welding 16SAW for its stability in sewage (I) and river (II) water, polluted by HM in WJ zones (HAZ, OM – the main material)

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Zeolite is an active polar adsorbent used in chemical fiber production together with new synergistic additives (SA), chosen with the help of computer modeling (method MNDO-PM3), by electronic and thermodynamic characteristics among heterocycles - imidazole derivatives, thiazole. Best SPC were used to clean soil, sewege water from HM and to protect steel, WJ from aggressive affect of the environment containing HM (soil, water), energy pollution, prevention of man-made disasters [12] (Tab. 1).

Table 1

Ensuring environmental and economic security with SPC for the complex unified scoring

Components of I_D, points	With no protection	With SPC	Complex protection
1	**2**	**3**	**4**
K_a	5	2	1
K_s	7	5	5
K_w	8	3	3
K_p	5	2	2
K_z	6	2	2
K_{EMF}	4	2	1
K_v	4	2	1
K_r	3	2	1
K_{km}	8	3	3
K_{mzv}	6	2	1
I_D	56	25	20
Points	6	3	2
Ecological-econimic secure level	unsatisfactory	satisfactory	normal

So, the components of I_D: K_a, K_w, K_s, K_{EMF} та ін. are reducing with the use of SPC and complex protection by 2…5 points, and I_D is reducing more than twice, and by the points – in two or three times. As a result a high level of the ecological-economic security of the PT is being provided (change from unsatisfactory to normal). The improvement of this technological method ensuring the environmental and economic security of the PT and its versatility is that not only the SPC cause protection against destruction of the PT modifying their surface by metalchelate resistant protective film, but also provide a reduction of the HM level - by linking them with metalchelation from mobile form into the fixed one. Polar adsorbent in their structure (zeolite) provides adsorption of metal-talohelatives (soil and sewege water are optionally cleaned from free cations of HM by ion exchange). As a result, the PSEE is formed. This is confirmed by the technical and economic, socio-ecological efficiency of the improvement of the technological processes, with the total economy expected $E_\Sigma = \sum_{i=1}^{n=7} E_i$ (Tab. 2) and the ecological loss prevented (W_Σ=22624.63 UAH/year).

Table 2

Total economy E_Σ on the improvement of the SPC with the elimination of the regional waste C

Components E_Σ, UAH/year			
E_1	164497.39	E_5	140120.0
E_2	3299.48	E_6	55000.0
E_3	6598.96	E_7	9264.48
E_4	59880.0	E_Σ	290660.31

3. Conclusions.

1. Greening of the economy with balanced use of natural resources: cancellation of losses of energy resources, underproduced product, compensation costs for elimination the concequences of industrial accidents (technogenic pollution of soil, sewege, biota, damage to PT etc.); is provided by

eco-management of the PT that includes the improvement of the technological processes with innovative technologies, secure to the environment.

2. The unified differentiated comprehensive assessment of the industrial impact on the PT designed makes it possible to predict, manage its environmental and economic security to give a synergistic positive environmental and economic impact (PSEE).

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