ANTITURBULENCE INFLUENCE OF SMALL FRACTIONS SOLUBLE GAS IN LIQUID

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One of the most famous ways of increasing the oil pipe-line capacity and extension of common pipe-effective pipe-lining transport is usage of antiturbulence additive (ATA).

ATA – antiturbulence additive – a reagent for the reduction of hydraulic resistance are some materials that are soluble in the following liquid, reducting stipulated with friction of loss pressure when liquid flows in channel or pipe-line.

Besides ATA usage gets on opportunity to increase the expense of liquid in the way of expensing the same energy or reduce falling pressure in such expense of liquid. Modern ATA in present time is used in the pipe-lining industry and consists of long –chaining hydracarboning polymers. They are used as a buffer layer between liquid and a walk of pipe and reduce a loss of energy for a vortex production.

Last time a scientific and engineering groups the interest to phenomenon of a reduction of turbulence friction in pipes leading into flowing pumping liquid of insignificant number of a polymering addition.

This phenomenon was discovered above 50000 years ago by English chemist Toms and it causes theoretical and practical interest in some reasons. First of all knowledge and solution of Toms' effect mechanism – a reduction of turbulence flowing hydraulic resistance goes to the process of turbulence appearing, generation and dissipation. Secondly, the opportunities of decision of the power saving problems in technological process of power-consuming objects, particularly transporting power-vehicle on main pipe-lines.

Additives have influence on the turbulence in the wall rates of oil pipe-line and stipulate the appearing of Toms' effect. It is shown in anomalous hydraulic resistance's reduction of turbulence flowing due to macromolecule additives. They have long form developing towards flowing, put out turbulence pulse and make a growth of thickness sticky rate in internal wall of pipe. In this way it held a common reduction of turbulence flowing degree and near axis pipe.

As a turbulence sphere in which Toms' effect is shown especially with small Rainold's numbers isn't defined approximately. In such a way the additive effectiveness in each case should be defined in empirical way.

Analyzing some literature I can say that only additions for oil (polymer) and water (Voytenko's works) were examined. But there are any other factors that put down a turbulence. As well the formulas for water-soluble and hydracarboning addition were given. Such phenomena can be noticed when gas bubbles inject in liquid flowing. Gas bubbles struck in a vortex of pumping liquid and play the same role as polymers.

It considered to be the fact the increasing of gas content in SBN like “Turo” from 0 till 0,035, in TSN RK from 0 till 0,07 and RK 0-0,12 is an increase of all pump parameters in comparison with pure liquid.

When the number of blades in the working wheel of a central pump is reduced, its parameters increase in comparison with pure liquid.

The practical usage of Toms’ effect is various: traditionally pipe-lining are greased by different additives; sea and river ships pressure columns in deep chinks are greased by polymers etc.

Toms’ effect is conditioned by a production on the bound solid body-liquid of molecular solution which cut down a turbulence of flowing. It was established that the addition of polymers is more effective in high flowing velocity. In this case the developing turbulence of flowing is bigger.

The peculiarities of Toms’ effect mechanism predetermine the necessarity of connection searching between physics-chemical qualities of soluble polymering macromolecule and changing hydrodynamical characteristics of turbulence flowing.

As it is known that the qualities of polymers have influence on the characteristics of turbulence flowing. Consequently, they represent the interest and first of all, it is molecule mass, flexibility of molecule chain, sticky bound macromolecule balls and their association. Without doubts that setting of the correlative dependence between physics-chemical qualities of soluble polymering macromolecules and changing of flowing characteristics open the way to purposeful synthesis of new hydrodynamical effective polymering additions.

Modern ideas about Toms’ effect are not limited by necessary conditions of this effect showing – turbulence flowing. The fact remains that turbulence flowing condition is necessary but it isn’t enough conditions in Toms’ effect showing. Particularly, this condition doesn’t point the limitations in turbulence characteristics (turbulence degree, frequency of turbulence pulse, turbulence scale) and also the characteristics of a polymer that can exist.

Stipulating a friction of loss pressure or hydraulic braking it appears a resistance which liquid flowing meets in a contact with solid surface, wall pipe, for example. As a rule, there are two kinds of flowings: laminar and turbulence. It’s impossible to change loss pressure in friction without changing physical liquid quality. As ATA don’t change liquid quality, they are effective only in the conditions of turbulence flowing. In most oil pipe-lines is a turbulence rate of flowing and that’s why modern ATA have a good influence in such oil pipe-lines.

Liquid moleculars move chaotic in a turbulence flowing. It leads to a vain loss of considerable part of energy in vertical flowing and other chaotic movement.

ATA work is in interaction of a polymer’s molecular with turbulence liquid flowing.

The same point of view proceeded from assumption that additive constantly resists turbulence in liquid flowing. It changes relatively flat profile of turbulence flowing velocity in pipe cutting into more stretching in axial direction.

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