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ENSURING THE STABLE OPERATION OF MACHINERY THROUGH THE USE OF MAINTENANCE LUBRICANTS

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Abstract
In recent years, the agriculture of Uzbekistan has relied on the complete mechanization of sowing, cultivation and harvesting operations. Expensive imported equipment is purchased. And how is this technique used, how is it stored, how many years will it serve the farmers? Previously, it was practiced to write off equipment after 6-7 years of being on the farm.
At the present time, the technology cannot pay for itself during this period. One of the reasons is the susceptibility of technology to corrosion. This article discusses the causes and consequences of corrosion, suggests ways to extend their service life.

Keywords: corrosion, engineering, chain transmission, preservation, corrosion inhibitor, lubricants, wear.

Introduction

Agricultural production occupies the main place in the economy of the Central Asian region. [1]. Despite the prevailing role of cotton growing, in recent years, vegetable growing, grain growing, horticulture and processing of grown agricultural products have also been developing at an intensive pace in the region. For example, in Uzbekistan, many specialized agricultural clusters have been formed, where each type of cultivated crop is processed to the final product[2].

One of the functions of the oil is to protect the surface of parts from corrosion. Corrosion becomes especially intense when the engine is operated in hot, humid climates. In this case, oil plays a double role: on the one hand, it protects the surfaces of parts from the aggressive influence of the external environment; on the other hand, the oil itself is corrosive due to the

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presence of corrosive substances in it.

The independence of these clusters has led to the fact that these clusters are focused on the main types of technology and technological equipment [3]. The specialization of most types of technology leads to the seasonality of their operation and long off-season downtime.

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2.Methods

We studied the state of equipment visually, with a visit to agricultural clusters, questioned specialists in the operation and storage of equipment, removed the units and lubricated them with different compositions, including newly developed ones. Laboratory studies, carried out in accordance with GOST 9054 (protective properties) and GOST 9490 (antiwear properties)[4].

Corrosion inhibitors are designed to protect the surface of engine parts from corrosion caused by organic and mineral acids formed during the oxidation of oil and additives. Their mechanism of action is the formation of a protective film on the surface of parts and the neutralization of acids. Rust inhibitors are primarily designed to protect steel and cast iron cylinder walls, pistons and rings[5].

3.Results and discussion

State standards for storage of equipment require short-term and long-term conservation, however, due to technological difficulties and the lack of necessary materials, they are not met. We have studied the fulfillment of the requirements of GOST 7751-2009 “Equipment used in agriculture.Storage rules”[6].

Clause 7 of the standard establishes the requirements for long-term storage of machines in closed rooms and under a shed, and clause 8 of the requirements for storage in open areas.

Practically more than one item of the requirements for engine preservation has not been fulfilled, open and threaded joints of hydraulic systems and working equipment, protruding parts of hydraulic cylinder rods are not covered with protective compounds.

Dirt and plant residues are not removed from the components of the harvesters, the cutter blades are not removed from their places, the equipment is stored in open areas without any anti-corrosion treatment. The situation is the same for tillage, sowing and other machines. Almost all equipment has badly rusted chain drives, steel cables, knives and plowshares[7].

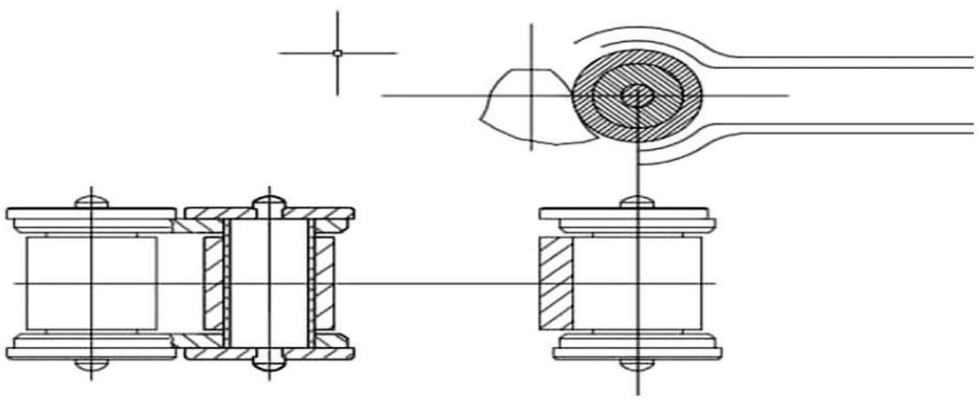

Fig. 1 Chain link

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A survey of agricultural workers showed their lack of awareness of conservation processes and protective materials. Most farm mechanics believe that commercial oils and greases can protect mechanisms from corrosion, and some find it useful to use them for external preservation of waste oil products.

However, research has established that regular or constantly used working oil products and technical fluids do not have sufficient protective properties, and after a certain period of their use, they actually cannot slow down the corrosion processes that have begun[8].

This can be clearly seen on the example of chain drives, which are widely used in almost all agricultural machines and technological equipment. Figure 1 shows the main assembly of the most common roller chain.

Lubrication of the roller sleeve unit is possible only with liquid oils, and then when the chain is dipped in the amount of oil.

Outdoor open chain drives do not have this capability. For their lubrication, traditional brands of lubricants are most often used, such as grease, lithol, etc. At the same time, the inner surfaces of the bushings and rollers remain without lubrication, these lubricants cannot penetrate into the clearances[9].

Figure 2. an approximate ratio of brands of lubricants used for open chain drives of agricultural machinery is presented.

Based on the survey results (Fig. 2), we selected 6 brands of lubricants and they were subjected to laboratory tests. Evaluated not only the protective properties, but also the main performance indicators: antiwear properties, colloidal stability, dropping point, according to GOST and accepted methods.In addition, the water-displacing properties were compared. The results are shown in Table 1[10].

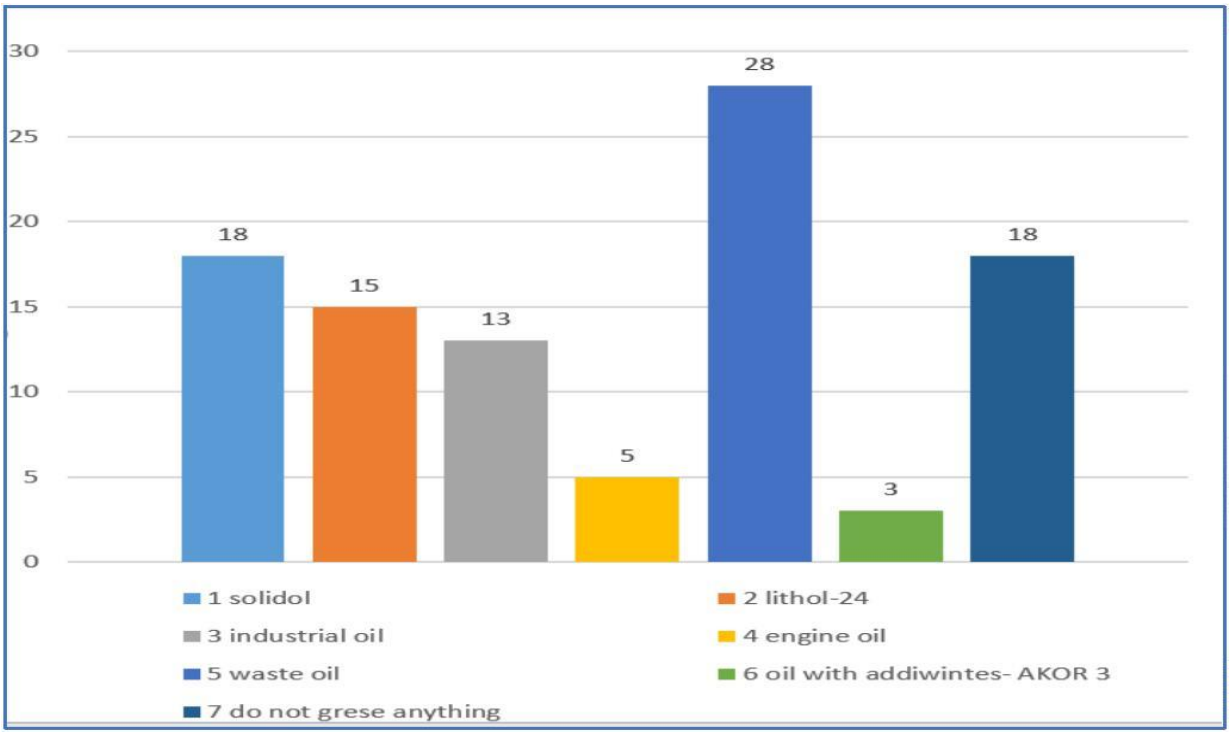

Fig. 2. Proportion of lubricants used for open chain drives (survey results in%)

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It is known that the total wear of any mechanism is added up as the sum of individual types of wear.

We have studied the wear of parts subject to preliminary corrosion. The results of testing on a four-ball friction machine showed that the parts previously exposed to corrosion were worn out 1.5-1.8 times more. This was apparently facilitated by a decrease in the fatigue strength metal surface due to corrosion damage, as well as the effect of rust particles as an abrasive element between rubbing parts.

We have studied the condition of the chains remaining on the equipment during the storage period and similar new chains. For 3 hours of study, the lengthening of 10 - links of old chains exceeded the wear indicators of new chains by 2.2 times. This confirms our assumptions about the role of corrosion, and explains the reason for the annual purchase of a huge number of chains as spare parts[11].

Table 1. Results of the study of the main indicators of lubricants

Indicators of lubricants 5% in I-20 oils	Solid oil (sample 1)	Lithiol-24 (sample 2)	Fresh engine oils (sample 3)	I-20 (sample 4)	Waste oils (sample 5)	Working and conservation grease (sample 6)
Protective properties (GOST 9054):% of the surface affected by corrosion, steel 10						
In a thermal moisture chamber G-4, 600 hours	26	6	40	66	30	4
When immersed, sea water 300 hours	24	10	4	28	75	3
Water displacement. (5%, in I-20A oil) diameter of the circle freed from water, mm after 5 min.	6	22	10	8	18	80
Penetration capacity in micro-gap, mm in 24 hours	4	12	16	10	15	40
Permeability (gland oxide), mm	3	5	12	12	14	20
Anti wear properties for a four-ball friction machine (GOST 9490-75), wear scar diameter, mm	0,9	0,52	0,4	0,98	0,8	0,5
For pre-corroded balls, wear scar diameter	1,42	0,71	0,62	1,24	1,7	0,75

Fig.4.Shows the main assembly of the most common roller chain

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Figure 4 shows chain corrosion for a combine harvester that has not yet been sold but is on the marketplace. This harvester, as well as other models of new technology, shows the beginning of corrosion of drums, plow plows, etc.

Fig. 5.Shows the corrosion damage to the parts of a working cultivator.

These facts substantiate the need to improve the standard for storage and development of a range of working and conservation lubricants containing combined corrosion inhibitors for periodically used equipment[12].

The composition of such inhibitors promotes penetration into microgaps, displacement of moisture from the metal surface, and the formation of chemo-sorption and adsorption layers on the surface, which strongly protect the metal from corrosion. The use of working – conservation materials, prolongs the service life of equipment, reduces the labor intensity of conservation work, saves significant funds and, as a result, reduces the cost of any type of product[13].

4. Conclusion

Cars, road construction and agricultural machinery are subject to corrosion in all climatic conditions, including in the hot climatic zone of Central Asia.

Large temperature fluctuations during the day, often observed in Uzbekistan, contribute to the formation of stagnant zones of moist air in hidden cavities and gaps between parts, which will provoke the onset of corrosion processes.

Strengthens the corrosion of corrosive particles of dust, mineral fertilizers and salts contained in the air, which enter these cavities by air[14].

The resulting layer of rust, at the first start-up of the equipment, increases the rate of general wear by 1.5-2.0 times.

One of the most accessible ways to protect such assemblies from corrosion and mechanical wear is the use of working and conservation lubricants that protect surfaces from corrosion and subsequent accelerated mechanical wear.

This is ensured by reasonably selected components of the lubricant, which, due to the differences

in the interaction energy, displace moisture from the surface, forming strong, thin chemisorption and adsorption layers in its place. Such materials should have, along with protective, antifriction properties, resistance to atmospheric precipitation, solar radiation and high temperatures[15].

The tested new oil-soluble sulfonate-type inhibitor significantly enhanced not only the protective properties of the oil, but, due to its surface activity, reduced the wear rate by 1.5-2.0 times.

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