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A.S. Bukanova, F.B Kairlieva, L.B Sakipova,
O.Yu. Panchenko, N.A Karabasova, R.N. Nasirov

Atyrau State University named after Kh. Dosmukhamedov, Atyrau, Kazakhstan
rnasirov.48@mail.ru

NEW APPLICATION OF OXIDATION-REDUCTION REACTIONS

Abstract. In this article, the application of new methods of oxidation-reduction reactions in three directions is considered.

Its first direction is in the role of an intermediate in the process of passage of organic reactions. When a weak CH-acid of triphenylmethane is reduced with sodium, in the first stage an anion-radical is formed and then a carbanion.

The second direction is the determination of vanadium metal in petroleum and petroleum products.In this direction, the photocolorimetric method was used before. Now, when burning oil residues from the ash formed (V_2O_5) by the interaction of hydrochloric acid, vanadium chloride is formed, which is determined by the EPR spectrometer. This new method is more efficient and accurate, compared to the conventional photocolorimetric method used in the laboratory.

In recent years, based on experiments conducted in the Atyrau region, a genetic link between nitrates and nitrite ionshasbeen established. Members of the circle tested the content of nitrate ions in plants using diphenylamine-4-sulfonic acid sodium salt. When exposed to reagents, the nitrate ion contained in the acidic juice of the plant is oxidized and stained from slightly violet to dark blue.

Keywords: anion-radical, electron paramagnetic resonance, vanadium, ash oil, photocolorimetric method, nitrate ion, nitrite ion.

Introduction. In the chemistry history, it has long been asserted that oxidation occurs when the elements are combined with oxygen. For example, many metals lose their properties under the influence of oxygen and are corroded (destroyed).

If the iron lies in moist air, then its surface is covered with red-brown rust:

$$2\mathrm{Fe}+\frac{3}{2}O_2+nH_2O\xrightarrow{25^0C}Fe_2O_3\cdot nH_2O$$

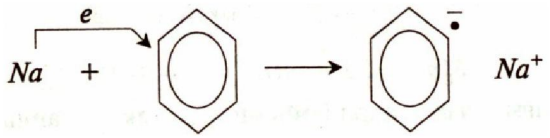
Likewise, all elements, apart from inert gases, react with oxygen and form oxides. Recently, complex physico-chemical devices and studies have shown that other chemical reactions lead to a similar conclusion. For example, metallic sodium not only reacts with oxygen, but also interacts with other compounds:

$$2\mathrm{Na}\overset{e}{\curvearrowright}+\tfrac{1}{2}\mathrm{O_2}\rightarrow\mathrm{Na_2O}$$

Also, sodium reacts with poisonous chlorine with the formation of an edible salt, having a unique taste and does not have its own smell:

$$2\mathrm{Na}\overset{e}{\curvearrowright}+\mathrm{Cl_2}\rightarrow 2\mathrm{NaCl}$$

Also, sodium reacts with benzene, and gives it one electron turning into an anion-radical of the organic salt [1]:



This compound has an unpaired electron that gives paramagnetic properties to benzene and has a negative charge.

When triphenylmethane reacts with sodium, it flows through the stage of the unstable anion-radical of triphenylmethane[2].

$$(C_6H_5)_3CH \xrightarrow{Na} (C_6H_5)_3CH^{\bullet -}Na^+$$

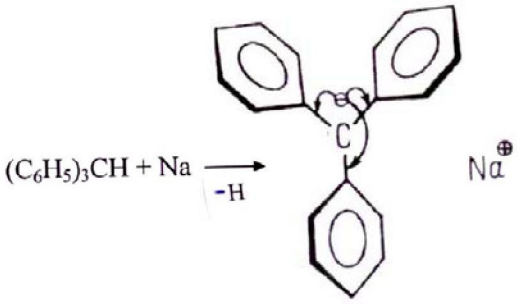
For sodium, this process is similar to each other. Since in four cases it gives up its valence electron and is oxidized.

In the first case - oxygen, in the second case - chlorine, in the third case - benzene, in the fourth case - triphenylmethane are oxidants. These reactions are simple methods of oxidation-reduction reactions.

Reaction of triphenylmethane with sodium

The mechanism of carbanion formation from the triphenylmethane compounds during the reduction with sodium occurs through the stage of the unstable anion-radical of triphenylmethane and is detected by the electron paramagnetic resonance (EPR) method.

Of the fatty-aromatic multinuclear compounds, the properties of the central carbon "methane" atom of triphenylmethane (TFM) are the most interesting. In the triphenylmethane itself, hydrogen bound to this carbon is relatively easily cleaved in the form of a proton under the action of sodium amalgam [3]:



triphenylmethyl anion
(red); λ=480 nm

The stability of carbanions (triphenylmethyl anions) with phenyl nuclei is due to the conjugation of the negative charge of the central carbon atom to the π-electron system of three benzene rings [3,4]. The triphenylmethyl anion is identified by UV spectroscopy in tetrahydrofuran (λ=480 nm)

The reaction of an alkali metal with triphenylmethane at low temperature (-110 °C) in tetrahydrofuran (THF) gives a new EPR spectrum consisting of 10 lines [2]:

$$N=2nI_H+1 = 2 \cdot 9 \cdot ½ + 1 = 10 \text{ line}$$

and the distance between the lines *a*=1,85 Gs (рисунок 1).

This unpaired electron in two rings is delocalized and magnetically interacts with equivalent four-ortho, four-paraand one-methine protons and, as a result, forms ten lines (the spin of the nucleus of hydrogenI_H = 1/2).