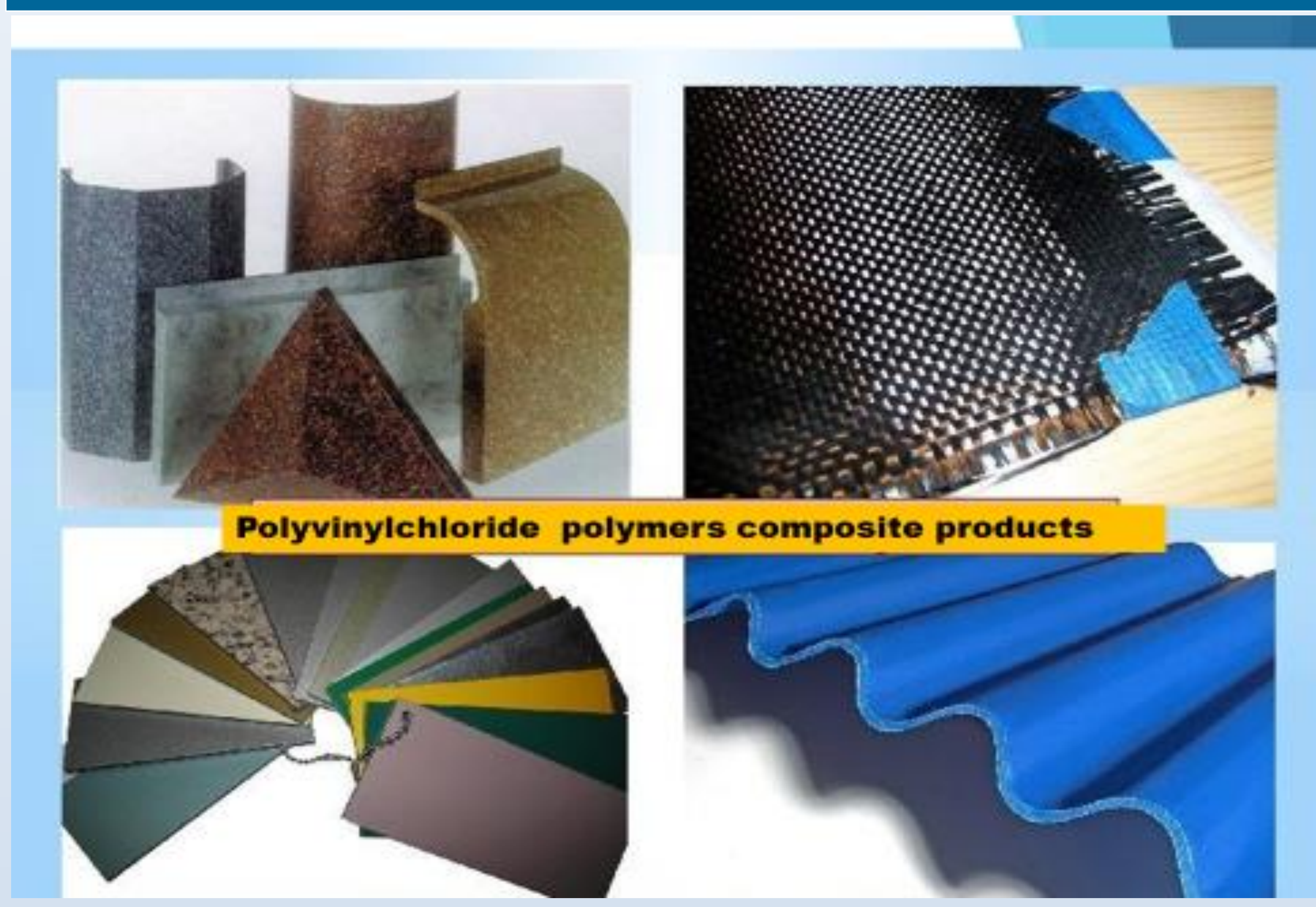
# Nanostructural properties of latexes for the synthesis of Polyvinylchloride

master **Natalia Fedorishin,** professor **Sergiy Kurta**
**Department of Chemistry Precarpathian National Vasyl Stefanyk University,**
**57 Shevchenko St., Ivano-Frankivsk 76018 Ukraine E-mail: kca2014@ukr.net**

## Introduction




The approach to mathematical modeling of vinyl chloride (VC) emulsion polymerization processes by different authors and the model proposed by Teplidis Hamalek and Mak Grigor are considered in the paper. Software for this model has been developed. A digital experiment was conducted to confirm the adequacy of reflection in the model calculation of the oscillatory nature of the process, the concentration of latex, the protection of latex particles with an emulsifier. It demonstrates the need to refine the model with consideration of the nanostructured collicence of the latex particles to accurately determine the size of the real latex obtained and its polydispersity.

The technology of industrial methods of emulsion and gas-phase polymerization of vinyl chloride on the surface of unmodified and modified pyrogenic highly dispersed oxides - silica ($SiO2$), alumina ($Al2O3$) and rutile ($TiO2$) has been developed. Obtained by polymerization filling, PVC emulsion was used as a component of PVC by plasticized organosols and plastisols, which had a stable low viscosity during long-term storage, transportation and processing into PVC composite products.. As a result of the gas-phase polymerization of vinyl chloride on the surface of fine silica, special fine fillers with adjustable particle sizes were obtained, which were used for the coating of synthetic and artificial leather, giving it light-scattering properties.

## Experimental methods ivestigation

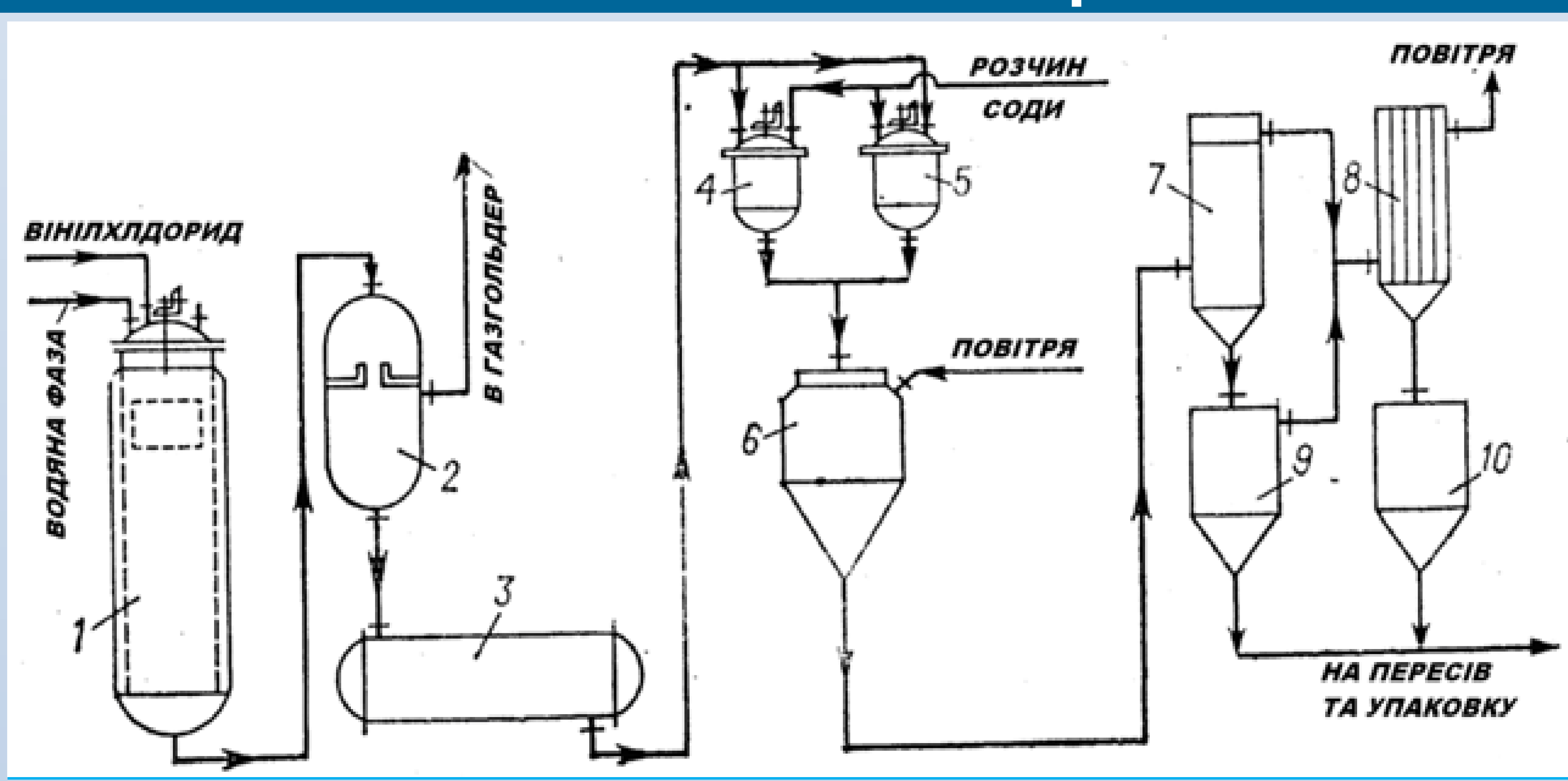



Fig.1. Technological scheme of industrial production of emulsion PVC on nanostructured seeds: 1 - reactor-polymerizer VH; 2 - PVC latex degasser; 3 - PVC latex collection; 4, 5 - devices for stabilization of PVC latex; 6 - spray drying of PVC latex; 7 - cyclone capture PVC powder; 8 - bag air purification filter; 9,10 - hoppers for collecting powdered emulsion PVC.

The figure shows the technological scheme (Fig. 1) of obtaining emulsion PVC E 6602-A on a seed of silica A-300, which is described and protected by the Patent of Ukraine №2781 / 1994 - "obtaining paste-forming PVC .which differs from conventional technology of obtaining emulsion PVC E 6602 -With no seed.This technology differs in that the emulsion polymer-rization of vinyl chloride is carried out in the presence of 0.01-0.03%, as a seed-highly disper-sed silica A-300 with a primary particle size of 10-30 nm, which leads to a change in the properties of PVC-E 6602-A, which was confirmed by us by calculating the particle size distribution of PVC latex E 6602-A Fig.2, and PVC powder so Fig. 3.

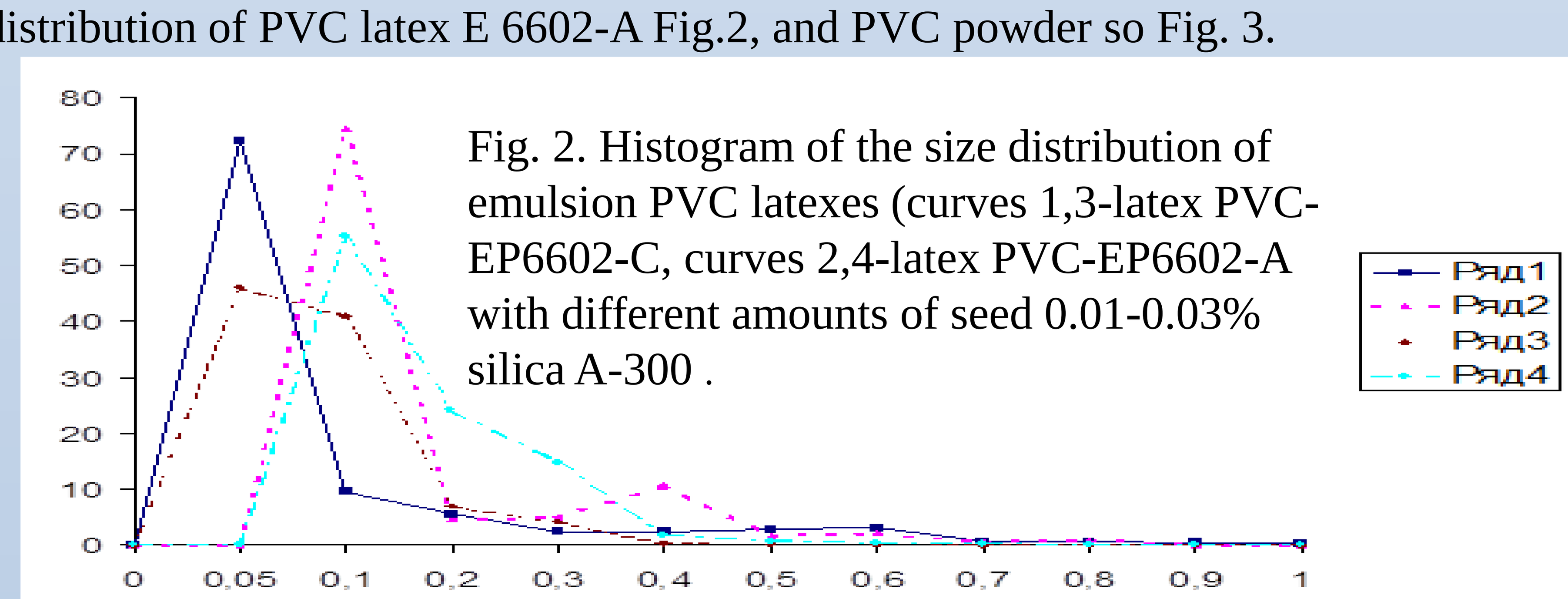



Fig. 2. Histogram of the size distribution of emulsion PVC latexes (curves 1,3-latex PVC-EP6602-C, curves 2,4-latex PVC-EP6602-A with different amounts of seed 0.01-0.03% silica A-300 .

## Results and discussion

We studied the sizes of latex particles of different brands of PVC, obtained on and without seeds. So in fig. In Fig. 2 shows histograms of the size distribution of PVC latex particles for emulsion PVC-E 6602 C (without seed) - curve 1, and for PVC-E 6602 A - curve 2 and 4, on a seed of 0.02% silica A-300 with a particle size 10-30nm - curve 3, fig.4. As can be seen from the analysis of the curves - histograms of PVC-E latex 6602 C (without seed) - (curve 1) has a significant polydispersity with a maximum in two areas of about 0.05 µm (average part size) and about 0.1 µm. For PVC obtained by seed technology PVC-E 6602 brand A (curve 3), is characterized by monodispersity with maxima in the region of 0.1 µm, ie there is a slight increase in the average latex particle size.

As can be seen from Fig. 3, curves 1,2,3 depict the particle size distribution of PVC powder -emulsion, obtained by conventional technology without flow (PVC brand -E 6602C), it is characterized by a wide polydisperse separation of powder particles with maxima in the region of 20 µm and 40 µm (microns) . This is the reason for its rapid swelling in the plasticizers DOF and DBF powders of conventional emulsion PVC-E 6602 C. At the same time for PVC-E 6602 A (curve 4, Fig.3) on the seed, characterized by a narrower particle size distribution, ie monodisperse, with maxima in one area, about 40 µm. As a result, this reduces the swelling of the PVC powder particles in the plasticizers. That is, there is a decrease in the initial viscosity of plastisols based on these PVCs in plasticizers with an increase in their survivability, stable viscosity during long-term storage. This is confirmed by the determination of the viscosity of these plastisols during storage in Fig.4, where the diagram shows the changes in the viscosity of plastisols prepared from different brands of PVC.

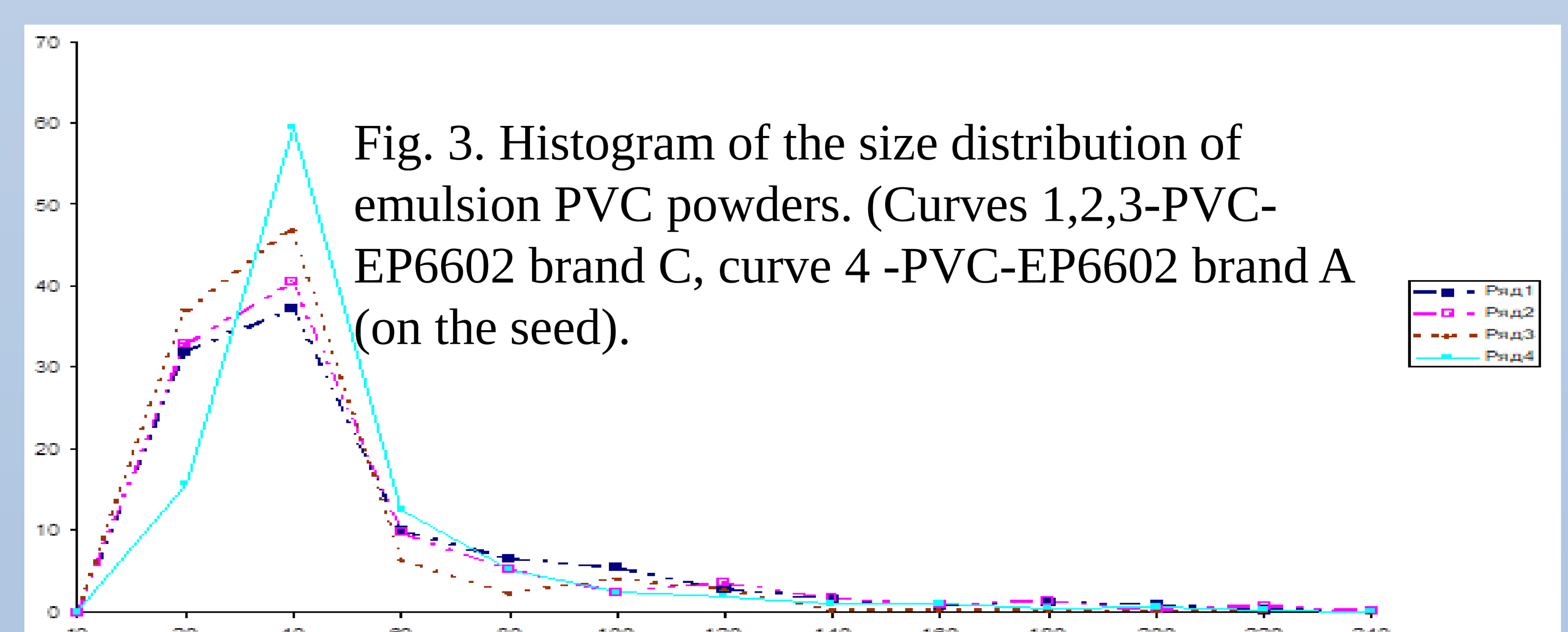



Fig. 3. Histogram of the size distribution of emulsion PVC powders. (Curves 1,2,3-PVC-EP6602 brand C, curve 4 -PVC-EP6602 brand A (on the seed).

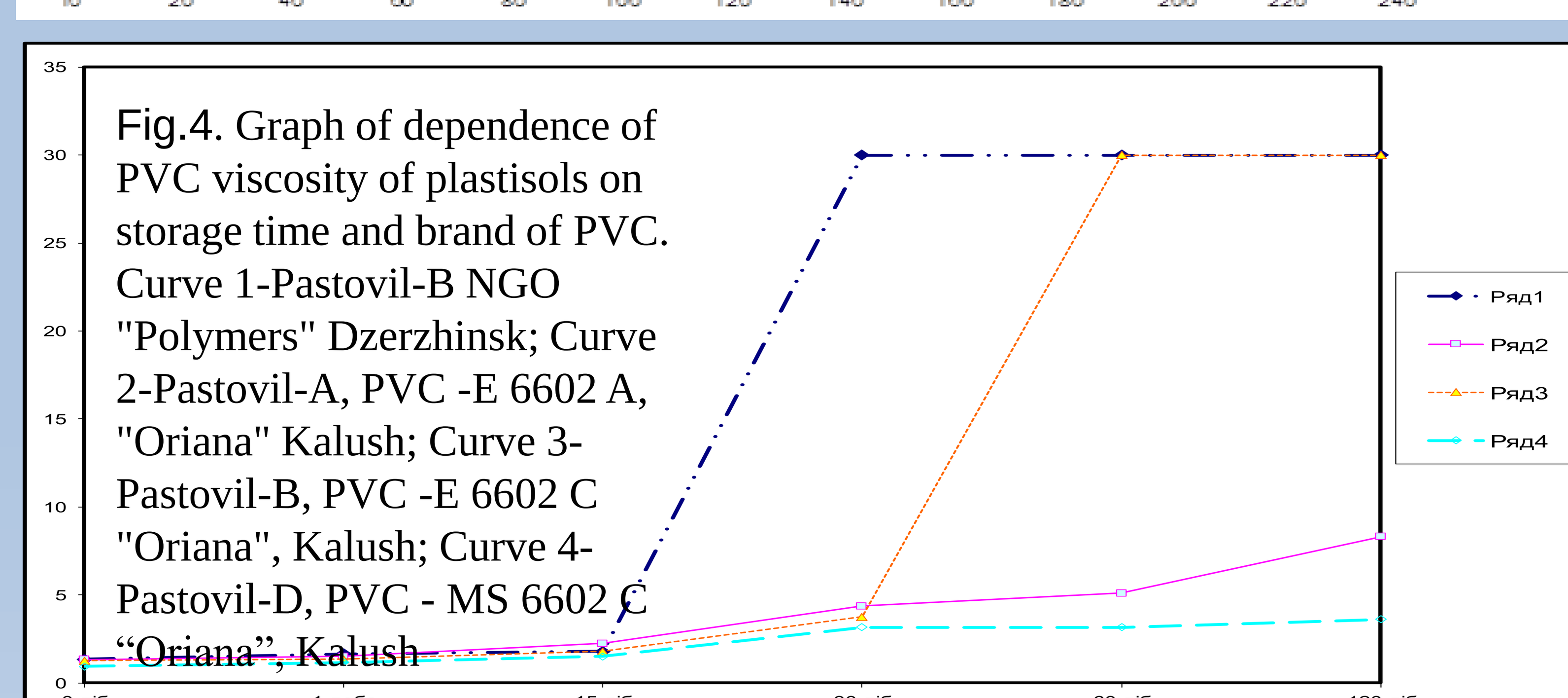



Fig.4. Graph of dependence of PVC viscosity of plastisols on storage time and brand of PVC. Curve 1-Pastovil-B NGO "Polymers" Dzerzhinsk; Curve 2-Pastovil-A, PVC -E 6602 A, "Oriana" Kalush; Curve 3-Pastovil-B, PVC -E 6602 C "Oriana", Kalush; Curve 4-Pastovil-D, PVC - MS 6602 C "Oriana", Kalush

## Conclusions.

1. Software was developed for the dynamic model of continuous emulsion polymerization of VH in the presence and absence of seed proposed by Peplis and Hame .
2. The possibility of continuous emulsion polymerization of IB with a seed of 0.01-0.03% of silica A-300, which led to a decrease in the amount of emulsifier E-30 from 3% to 1.5% in the complete absence of fluctuations in the polymerization of IB.
3. It has been shown that the seed dosing techniques used allow to obtain latexes and PVC with a wide range of properties, including bimodal particle size distribution, which make it possible to prepare low-viscosity PVC plastisols, with 2 times increased shelf life and processing.
4. On the equipment of industrial production of PVC seed latexes used for dosing in continuous processes of obtaining emulsion PVC are synthesized. Experimental and industrial samples of emulsion PVC-E-6602A were obtained, approaching the properties of micro-suspension and imported brands of PVC.