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The phenomenon of celestial bodies' influence on the long-range order in polyethylene glycol and its dynamic viscosity

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ABSTRACT

Long-range order in liquid polyethylene glycol with a molecular weight of 400 Da (PEG-400) and in PEG water solutions (up to 0.00001 wt. %) was investigated in the temperature interval 283 – 368 K and at normal atmospheric pressure by the gravitation mass spectroscopy. This structure is represented as collapsed clusters, consisting of 4 and 7 polymer molecules, and as their associates (dimers, tetramers) containing 11, 16 and 22 PEG molecules. It was found that the cluster structure of PEG will be destroyed by water. The number of cluster kinds of PEG remains constantly 50 ± 3 and weekly depends on concentration and temperature. Models for collapsed PEG clusters consisting of 4 and 7 molecules are given. The clusters of 4 molecules are destroyed easily under the light and mechanical influence and under water addition. At the PEG concentration in water of 12 ± 3 wt. % the long-range order changes which is connected with an increasing of the average molecular weight of the PEG clusters. Furthermore, the gravitation radiation of celestial bodies (Sun, Moon, M34, and VIRGOHI21) was found to influence the dynamic viscosity (DV) of PEG. Weak gravitation radiation (GR) of PEG was concluded to interact by resonance with GR of celestial bodies. © 2011 Trade Science Inc. - INDIA

KEYWORDS

PEG;
Clusters;
Celestial bodies;
Viscosity;
Gravitation;
Direction.

INTRODUCTION

By Cojocario and Natansohn^[1], macromolecule chains in liquid PEG were shown to be in the twisted conformation where the chains' ends are near with each other. Furthermore, Wang and Krenzer^[2] found out that the PEG chains are of spiral conformation, that shall be favoured by water. The distance between meanders in the spiral they evaluated to be 0.5 nm. On the other side, as shown by statistical mechan-

ics, the distance between the ends of 12 members' chains are ~ 2 nm^[3] and the entropy and energy of conformation about $8.3 \cdot 10^{-23}$ J/K and 1.5 kJ/mol, correspondingly. These data also underline the twisted character of PEG chains. It is informed about a special dependence of chemical reactions velocities of the terminal OH groups on the polymer chains' length though without an explanation for it^[4]. The authors suggested the idea only that the inter-chain interactions in PEG influence chemical reactions.

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By the Alessi group the spiral conformation of PEG in non-water solutions has been described as well as, that coil conformations shall be formed by PEG in water solutions^[5].

All this took us to the thought, that there is a well organized long-range structure in liquid PEG. To understand it permits to explain much of its properties for example, pore formation, surfactant and plasticator properties.

In our earlier works we described the phenomenon^[6-8], that protons of hydrogen bonds (water, starch, agarose hydrogel) shall be dissolved in physical vacuum (PV) under the influence of planets' gravitation radiation. The resonance between the weak gravitation radiation (WGR) coming from molecular matter and the gravitation radiation (GR) of planets was shown to cause this phenomenon^[8]. This proton dissolving and condensation in PV have to change the macro characteristics of the sample e. g. viscosity, surface tension or adsorption. It should therefore be interesting to examine this phenomenon by analyzing the viscosity of these synthetic polymers containing hydrogen bridges (HB).

The aim of the present work was to investigate the long-range order (LRO) in liquid PEG and in its water solutions (> 0.00001 wt. %) by the gravitation mass-spectroscopy (GMS) as well as how it shall be influenced by planets' GR.

EXPERIMENTALLY

Liquid polyethyleneglycol-400, the dynamic viscosity can be measured easily using a rotating metal cylinder (isolated and earthed box) with a minimal measuring error, was chosen as the investigation object. 11 ml of PEG-400 (Merck, 1150 kg/m³, 7.3 sSt) were placed in the measuring cell of "Reotest-2" (measuring error = 4 %) supported by a computer equipment which makes a measuring possible within the first 0.16 s of the cylinder rotation. The rotation time was equal to 3 s with a relaxation interval for the PEG sample of 60 s. The device was placed in a temperature-constant room ($\pm 0.2^\circ$) and it was additionally protected from seismic waves^[6]. The determination of planets' constellation proceeded according to the Zaytzev computer program ZET 9 (www.astrozet.net). The co-

ordinates of the measuring place were equal to 53° 38' n., 12° 35' e. SPGPR has to understand as the plane going through the Earth rotating axis and the sample place on the Earth surface (slide plane of gravitation proton resonance, SPGPR). The computers were calibrated with the help of radio signals. CET is the Central European time. The PEG gravitation mass spectra (GMS) which were earlier called as FNS (flicker noise spectroscopy) were recorded with the Zubow gravitation spectrometer^[7], according to the method given in the works^[9,10]. Here the PEG sample was placed in a special earthed, metal box, that was isolated from energy flows (heat, noise, mechanical and light)^[6]. The box was 10 m away from the viscosimeter.

RESULTS AND DISCUSSION

In Figure 1, the GM spectra of clusters in liquid PEG shall be shown. Differently as in water^[11], LRO in PEG has been changed more slowly. The spectra were found to be reproduced with high stability. As shown in Figure 1, PEG possesses LRO at the level of clusters (oscillators with masses up to $1g\ m < 3.5$) and super clusters ($1g\ m > 3.5$). Clusters were divided into collapsed and expanded ones where their distribution isn't uniform. Their formation/destruction energies were ob-

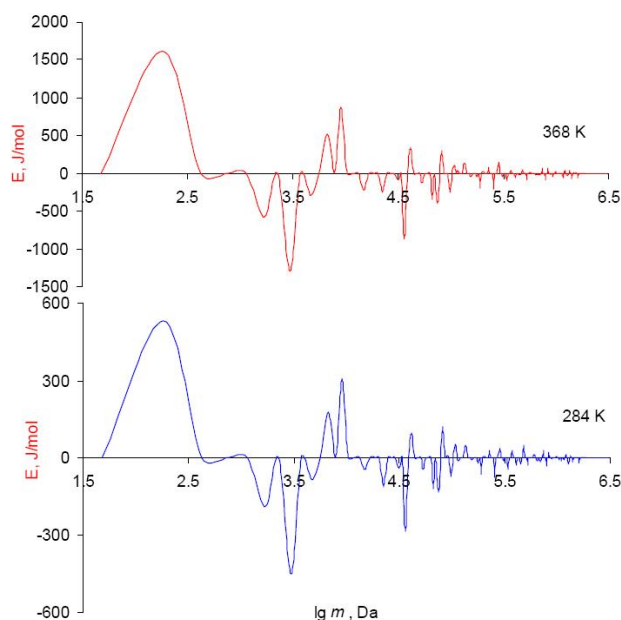


Figure 1 : Energy GM-spectra of PEG. The amount of PEG molecules in clusters is marked with a number opposite the signals. Zubow constant $5.9E-15$ N/m, strong shock wave^[9].

served to be around $-1.5 \dots 2$ kJ/mol. Therefore, PEG is less a homogeneous liquid but rather a heterogeneous nano-emulsion consisting of molecular clusters in the liquid polymer.

In liquid PEG, the following signals for small clusters were observed: $(\text{PEG})_4$ (7.3 kHz), $(\text{PEG})_7$ (5.5 kHz), $(\text{PEG})_{11}$ (4.4 kHz), $(\text{PEG})_{16}$ (3.7 kHz), $(\text{PEG})_{22}$ (3.2 kHz), $(\text{PEG})_{36}$ (2.5 kHz) and $(\text{PEG})_{54}$ (2.0 kHz) etc.. The strong signal at $\lg m = 2.6$ belongs to the oscillation of small spirals, that are built by 5-membered PEG chains, as shall be shown below (Figure 2).

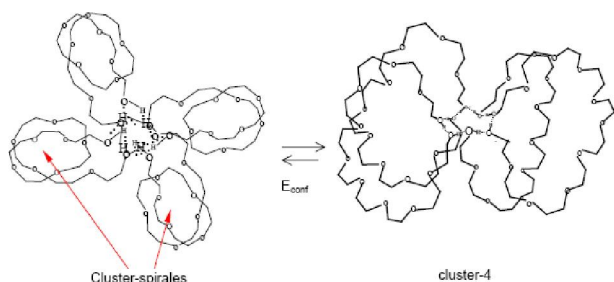


Figure 2 : Model for the oscillation mechanism of small spirals (expanded clusters, 22.2 kHz) into cluster-4 (7.3 kHz). Spirals before the shock wave influence are marked by arrows, the nucleus of the cluster-4 shall be shown in Scheme 1, see below.

At forced destruction of LRO e. g. at heating of 283 K to 303 K, a new expanded oscillator with a mass of 9 PEG molecules and a signal intensity, that is 120 times higher than that one at 283 K, was observed although this at further warming to 323 K disappears again. Additional warming led to changed signal intensities in the area of large clusters ($> \lg m = 5.5$) only.

In the GM-spectra of PEG, that was subjected to the influence by light, shake or dilution with water, the signal of cluster-4 disappeared. Furthermore, in PEG and in its water solutions, there were not found the signals of cluster-2 and cluster-3 as well as those for coils consisting of single molecules. The oscillations of other clusters and cluster associates remain almost untouched of this influence. We believe that as for salt solutions^[12], time is needed to achieve the thermodynamic balance in the liquid PEG solutions and in liquid PEG; this time is remarkably higher than the time of the technological application of this pore-building substance (template).

The absolute formation energy of the cluster-4 was found to be three times lower than the conformation energy of the polymer chain (Figures 1 and 3) which is

a proof for its structure given in Figure 2.

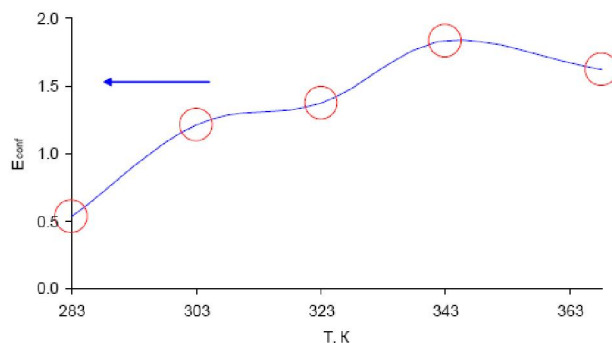
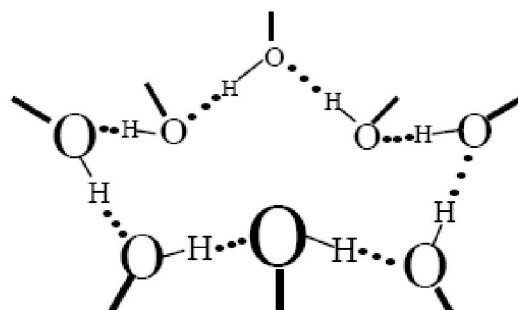


Figure 3 : The oscillation energy of spirals (conformation energy, kJ/mol) in PEG chains versus temperature. Results were obtained after device calibration with distilled water^[10]. The values of Livadara L^[3], marked with arrow, agree well with our results (1.2...1.8 kJ/mol) in the temperature interval of 303 to 373 K.

Therefore, the cluster-4 $\{\text{HO}-[\text{CH}_2\text{CH}_2\text{O}]_{10}-\text{H}\}_4$ was concluded to consist of core and shell of polymer spirals. Its core is built by eight terminal hydroxyl groups (Scheme 1) although it doesn't show any signals in the GM spectra.



Scheme 1

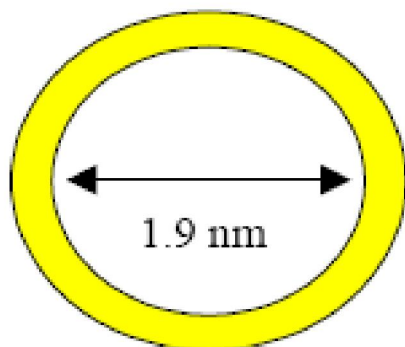
The spirals in liquid PEG belong to expanded oscillators (+f), they melt and get expanded under the shock wave influence. These signals are the strongest ones in the GM spectra (Figure 1). The signal intensity ratio of spirals to cluster-4 cannot be higher 4:1 (Figure 2).

On the other side, it is known that polyethylene oxide, an analog to PEG, crystallizes in a monoclinic primary building unit consisting of four polymer chains' fragments in spiral conformation^[17]. One can therefore imagine the oscillation of the cluster-4 as an oscillating sphere as the product of the cluster rotation (Scheme 2).

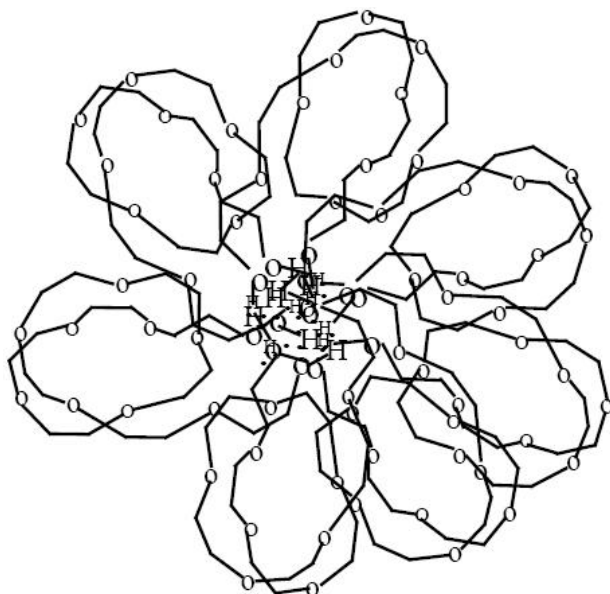
The sphere diameter is of ~ 1.9 nm. Under consideration that the distance to the surrounding molecules is of ~ 0.2 nm, a porous material with

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mesopores around 2.3 nm can be expected. Such mesopores were described in the works^[13-16] and they could serve as a proof for the models cluster-4 and cluster-7 (Scheme 3).



Scheme 2



Scheme 3

The cluster-7 oscillates as a collapsed one and its structure can be seen as a cluster-4, that has three additional PEG molecules though, differently as for cluster-4, there are 14 terminal OH groups in its core connected to each other by hydrogen bonds. These hydrogen bonds stabilize the cluster-7 structure. The oscillation intensity of the cluster-7 was observed to be two times higher than that one of the cluster-4 (Figure 1). It has to be mentioned that Chaplin (<http://www.lsbu.ac.uk/water/index.html>) described the main role in the formation of large water clusters ($(\text{H}_2\text{O})_{280}$) to the small ones consisting of 14 molecules.

Thus, the cluster-4 and cluster-7 are the main kinetic units in LRO of PEG.

Clusters with masses of 11 and 22 PEG molecules oscillate as expanded structures. Probably, they are dimere associates of cluster-4 and cluster-7 (cluster-11) and of those of two cluster-11 (cluster-22). Their GM signals are shown only weakly and they are typically for associated clusters (Figure 1). The clusters with masses of 36 and 54 PEG molecules are represented in the collapsed form; those structures are different from those of the cluster-4 and cluster-7. The Cochrane modeling of these large clusters didn't yield any clear answer.

The cluster-4 and cluster-7 associates' oscillation as collapsed structures (cluster-11) could be an indication that these clusters flow together in the liquid PEG even on core level.

Furthermore, at 347 K abnormal deviations in the distribution of clusters, in their energy formations, in the number of cluster kinds as well as in the average molecular masses and in the content of collapsed clusters were observed in liquid PEG. At this temperature seems to precede a structure redesign in LRO, analogous effects we found for other organic liquids and water^[11]. As shown earlier^[17] polyethylene oxide, a PEG analogous, produces clusters at the reaction with water too although the authors didn't give any explanation for it. Using the GM spectroscopy the authors of the present work found out that PEG form in water solutions some clusters (Figure 4). The average cluster mass $M_{\text{GMS}} = \sum |f| \cdot m$ in PEG water solutions was found to have

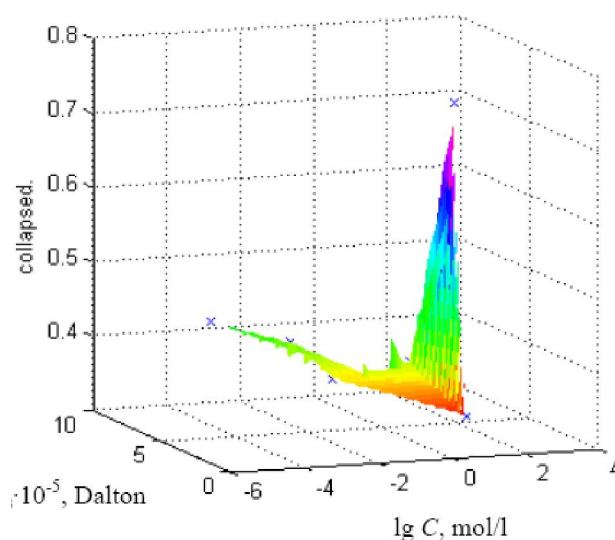


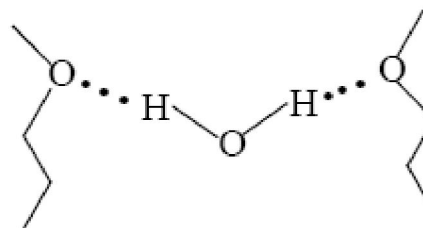
Figure 4 : Influence of the PEG water solution concentration (C) on the part of collapsed clusters and on the average cluster mass (M_{gms} , Dalton), 283 K.

a maximum at 12 ± 3 wt. % (284 K). Both decreasing and increasing of the PEG concentration lower or higher than 12 ± 3 wt. % led to a smaller M_{GMS} where in diluted solutions it particularly decreased fast. This concentration maximum agreed well with the value of 14 wt. % for modified PEG water solutions found by Cojocario^[1] being an indication for LRO reconstruction in liquid water surfactant solutions, probably.

In PEG and in its water solutions, there was analyzed a stable cluster with a mass of 1602 kDa, that is present at all investigated temperatures. It is possibly a boarder cluster in the statistical cluster ensemble hence larger clusters destroy by heat (kT). We believe that these cluster giants don't have sufficient cohesion energy to hold the cluster together under strong heat influence. The concentration of collapsed clusters in solutions was found to be in the interval of 56 to 62 wt. % of all clusters where the maximum at 62 wt. % was described to the PEG concentration of 1 wt. %. As the temperature rises the part of collapsed clusters in PEG increases from 56 to 58 wt. %. If the water concentration in the solution rises then LRO destruction of the polymer proceeds which leads to reduced amounts of PEG cluster associates (increasing M_{GMS}) where this effect is the strongest at a PEG concentration < 10 wt. %. The PEG cluster-4 hasn't been observed in solutions. Analyzing the PEG GM-spectra, which were obtained by subtracting the water GM-spectra from those of the PEG water solutions (LRO of PEG only^[7]), it shall be shown how strongly the spiral oscillations (Figure 2) depend on the solution concentration. The PEG clusters associates are in the expanded form if the PEG concentration is higher 10 wt. % whereas the cluster-7, -11, -16 were analyzed to be in the collapsed one, mainly. At this concentration, the solvent doesn't seem to influence the cohesion interaction inside the polymer cluster. However, at PEG concentrations lower 10 wt. % (better of 1 wt. %) the situation changes dramatically, in the polymer chains; the concentration of the expanded clusters is equal to that one of the collapsed. After a further dilution the collapsed clusters dominate over the expanded ones, this is possible only when one water molecule is installed into the spiral structure and when it connects the chains' segments lying opposite with each other by hydrogen bonds (Scheme 4).

In^[18-20], there was informed about the intermolecu-

lar interaction of PEG chains with water molecules. The cross linking of chains by water, according to Scheme 4, we found to transform expanded oscillators in collapsed ones. To Oesterhelt^[20], the installation of water in PEG is connected with the formation of a non-planar super molecular structure, that shall be stabilized by water molecules and characterized by a free formation energy of $1.2 \cdot 10^{-20}$ J^[20].



Scheme 4

As visible in Figure 5 with decreasing PEG concentration the energy of cluster oscillation decreases indicating the PEG cluster destruction in a "good" solvent – water. The course of the curves 1 (cluster-7) and 5 (spiral oscillation) seems to be interesting hence they change oppositely there could be a connection between the two events.

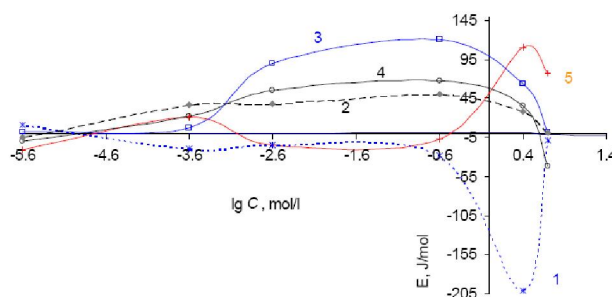


Figure 5 : The oscillation energy of small PEG clusters and their associates in water solutions. The value E was obtained by using an internal standard, spiral oscillation in PEG chains (Figure 3), and the difference between the cluster signal intensities in solutions and those in the solvent. 1 – cluster-7, 2 – cluster-11, 3 – cluster-16, 4 – cluster-22 and 5 – PEG spiral.

The spiral expansion in PEG chains caused by water leads to the collapsed cluster-7 which is condensed still more strongly under the shock wave influence of the device. The relation of the other clusters to the PEG spiral is comparable with cluster-7, shown less strongly, though. At the PEG concentration in water of $\sim 12 \pm 3$ wt. %, the density of all clusters has been strongly increased with the exception of the cluster-7 whose density on the contrary is highly reduced. It becomes expanded under the influence of weak shock waves from

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the side of the spectrometer. Above it has been mentioned that at this concentration the average molecular cluster mass has a maximum. This anomaly was explained to be caused by that the macromolecule ends approached strongly^[1]. At this concentration, a structure transformation on the LRO level takes place that leads to the appearance of new clusters, to a changed clusters' interaction with the surroundings and to a new thermodynamic balance, probably.

In Figure 6, the change of the dynamic viscosity of PEG at the time when the Earth lies on the line connecting the Sun and giant mass clusters of dark matter (VIRGOHI 21) in Virgo sign shall be given. At the opposition of giant mass concentrations to PEG, the polymer viscosity has been decreased strongly and reversibly leading to negative values. The negative viscosity can be understood only as the result of highly weakened hydrogen bonds. The interaction of the polymer with the metal surface of the measurement cylinder seems to be reduced so strongly that its viscosity decreases more than at the cylinder rotation in air (control). Thus, the giant mass concentrations of the Sun and VIRGOHI 21 shifted the balance proton – vacuum to the side of proton dissolving in the physical vacuum^[8], a sucking out of the boson protons in PEG HB in physical vacuum proceeds where the Earth is transparent for such a form of gravitation. In this case we have to do it with the secondary gravitation namely with the “ripple” of the main gravitation waves^[21] which spread with light speed^[6].

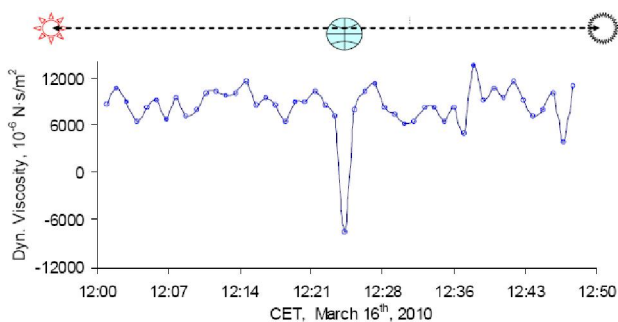


Figure 6 : Dynamic viscosity of PEG when VIRGOHI21 and Sun are in an opposite constellation and they are in SPGPR.

As visible in Figure 7 the weak gravitation radiation (WGR) from PEG is in resonance with GR of planets where all planets shift the balance proton – PV to the dissolution side accompanied with viscosity decreasing. Because the reverse viscosity reductions were much

higher than the measuring error of the device (4%) these signals were ascribed to the planets' constellation. We believe that they were caused by GR of mass concentrations in the space and/or GR waves' interference inside the sample^[6,8]. On December 6th, the planets were thick besides each other and on the same side facing the sun and their influence on the polymer viscosity was investigated at the time when they appear in SPGPR. Even such little masse concentrations like the dwarfes Mercury and Pluto influence the viscosity. The Sun influence is here much lower than in the case of opposition with the dark matter (Figure 6).

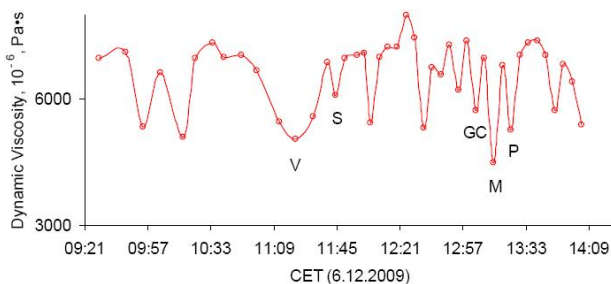


Figure 7 : Change of the dynamic viscosity of PEG at 289 K on December 2009. V - Venus in SPGPR, S - Sun in SPGPR, GC - Milky Way center in SPGPR, M - Mercury in SPGPR and P - Pluto in SPGPR.

Furthermore, it could be interesting to analyze whether the Earth satellite the Moon change the PEG viscosity. In Figure 8, there are the observation results when the Moon appears in SPGPR. The viscosity behaves here quite differently it is reversible and it rises spontaneously to understand this that the PEG adheres to the measurement cylinder surface more strongly due to reinforcements of the hydrogen bonds. In this case when the Moon appears in SPGPR the balance proton – vacuum shall be shifted to the side of proton condensation from vacuum.

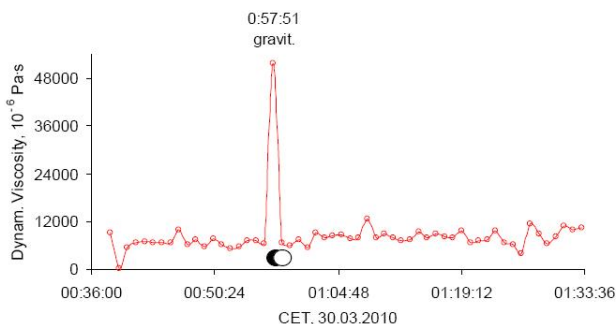


Figure 8 : Change of the dynamic viscosity of PEG at 290 K at full moon and Moon appearance in SPGPR (Moon - Earth - Sun, 178°).

These effects can be explained only from the position of a newly developed understanding of the molecular matter namely it is built by mass cluster ensembles^[6,8,9]. The potential energy of cluster ensembles of the Moon is smaller than those of the Earth^[7]. This leads to that the Earth removes the gravitation energy from the Moon by the reinforcement of proton condensation from vacuum in hydrogen bonds in the sample.

Under the same conditions, though without, that the Moon is in SPGPR but that it is together with the Sun in opposition to the Earth (4:25:28, 180°, Figure 9) the effect repeated however with a reduced viscosity. The Moon can cause only together with the Sun decreased PEG viscosities. Here in this figure, we see the influence of the gigantic mass concentration M34 on the PEG viscosity when it appears in SPGPR. M34 dominates over the Earth proton ensembles too therefore, it removes the gravitation energy from the PEG sample which causes a shift of the proton – vacuum balance to the dissolving side and decreases the PEG viscosity. There even would be this effect if M34 was on the opposite side of our planet.

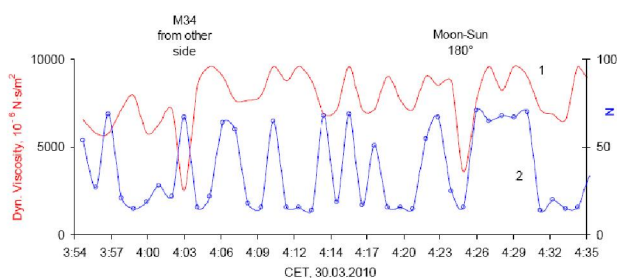


Figure 9 : Change of the dynamic viscosity (1) and number of cluster kinds (2) in PEG at full moon (Moon - Earth - Sun, 180°), 289 K. Distances to Moon 364687 km, to Sun 149,784,000 km. The normal value N (without gravitation exciting) is equal to 67. PEG cluster ensemble up to 3 million Dalton.

It is visible additionally that the cluster number doesn't change synchronously with the viscosity. For M34, LRO destruction in PEG was assumed to cause an increasing of the number of cluster kinds up to the normal conditions as well as a viscosity reducing. But for the case of the Sun – Moon – opposition, a decreasing of the viscosity is connected with that one of the number of cluster kinds. Therefore, at opposition of Sun and Moon, the hydrogen bonds in PEG shall be influenced selectively. At this time, the part of collapsed clusters was observed to be the highest (100 %). The

decreased viscosity has been explained by a destruction of the inter-cluster hydrogen bonds, therefore. Since the inter-cluster HB are very tense and mobile this selective destruction has to be understood from the position of two stimulating events: the proton condensation in HB by the Moon and the proton dissolving in HB by the Sun. The sun has an influence on the inter-cluster HB, the moon, however, on those inside the clusters. It has to be mentioned that at this time (full moon, 30.03.2010, Figure 9) in the next neighborhood to the measuring place – in Norway - all computer communication networks were out of order and for their repair several hours were necessary. This event is the result of a reversible LRO destruction of the molecular matter caused by planets' GR^[6-8] and in the present case - by the full moon phenomenon.

The dependence of the cluster mass on the oscillation frequency (ω , Hz) is described satisfactorily with the following the First Zubow equation^[6]:

$$m = 10^{11} \cdot \omega^{-2}$$

The first six to nine sequence members of above investigated clusters, of clusters in natural water^[10], in distilled water^[11], in polymers^[9,12], as well as in solutions^[22], in alcohols and hydrocarbons^[7,11], in protein and polysaccharide coils (lysozym, L-arginin, chymotrypsinogen-A, amylopectin^[7,9] etc. (see^[7]) were well described by the Second Zubow equation^[6]:

$$m = (260 \pm 20) \cdot N^{(2.08 \pm 0.05)}$$

Deviations were observed for $N > 9-13$ and the dependence of the cluster mass (m) on its number (N) shall be characterized by a polynomial of the 6th order of magnitude.

The existence of such a stable row for quite different substances and for their states cannot be accidental. A convincing explanation could be that it arises in stationary waves of white noises, which penetrate the Earth^[6-8]. The stability of this row can be destroyed e. g. under temperature influence that charges white noise with thermal components and changes it to color noise. For example, at heating of a water NaCl solution up to 368 K, frequencies and masses of oscillating solvated clusters of ion pairs^[23], were shifted to higher masses and at fast quenching of SiC Nan particles ($\sim 10^6$ K/s) from plasma of adiabatic compression^[24] - the harmony of this row was destroyed. The „magical“ benzene cat-

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ions^[25,26] also don't fit in this sequence because they are formed in color noises.

CONCLUSIONS

Clusters and super-cluster formations (cluster associates) were concluded to be the statistically most probable structures in the long-range order of liquid PEG where the smallest cluster is represented by a polymer chain spiral consisting of 4 to 5 members. Clusters of four and seven PEG molecules are the base units in the long-range order which are built according to the principle of core and shell. Whereas the core consists of terminal hydroxyl groups the shell is built by polymer chains. The cluster-4 isn't stable and it shall be destroyed at polymer dissolution in water. Water destroys the long-range order in PEG. At 12 ± 3 wt. % a structure transformation in the long-range order of the solution takes place. Using the viscosimetry together with the gravitation mass spectroscopy the nature of the gravitation radiation and the gravitation radiation direction as well the state of the gravitation field in the sample space can be analyzed. The application both of the viscosimetry and the gravitation mass spectroscopy permits to understand the mechanism of the long-range order destruction in molecular matter and to develop a new communication channel.

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