



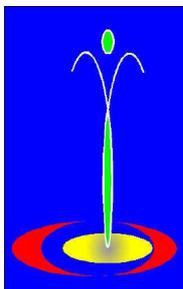
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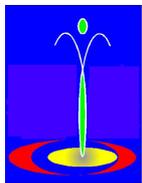
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# Contents

<b><i>PART I: Biomaterials and Biopolymers</i></b> _____	<b>1</b>
Effect of setting time on the rheological properties of suwari gels made with squid surimi + Konjac glucomannan _____	2
Rheological characterization and thermogravimetric analysis of oleogels containing isocyanate-functionalized biopolymers as gelling agent _____	3
Influence of chitosan content on the rheological bending behaviour of injection molded albumen based biocomposites _____	4
Evaluation of acylation reactions to improve chitosan thickening and gelling properties in castor oil _____	5
Egg albumen/tragacanth gum based bioplastics plasticised with water/glycerol mixtures _____	6
Characterisation of crayfish flour-based bioplastics processed by injection moulding _____	7
Injection-moulded bioplastics from rice husk protein _____	8
Phase diagrams of kappa/iota-hybrid carrageenans: the role of chemical structure and type of salt. _____	9
Does aquaculture of <i>Mastocarpus stellatus</i> in an IMTA impact on the chemical and rheological properties of extracted carrageenans. _____	10
A study on the alterations in skin viscoelasticity and hydration level before and after a topical administration of a surfactant free emulsion _____	11
Rheology of a <i>Staphylococcus aureus</i> culture during growth _____	12
Rheological and thermogravimetric response of an acylated chitosan gel-like dispersion in castor oil and traditional lithium and calcium lubricating greases: a comparative study _____	13
Development of protein-based composite materials by thermomechanical processing _____	14
Shear and elongational flow measurements of PCL/PLA blends _____	15
Rheology of hydrogels based on poly(ethylene glycol) and chitosan crosslinked with Laponite RD _____	16
Rheological study and physical stability of emulsions formulated with alpha-pinene and hydrocolloids _____	17
Rheological investigation of chitosan/poly(vinyl alcohol) mixtures _____	18
FucoPol as thickening agent and stabilizer of water in oil emulsions _____	19
Synovial Fluid Hyaluronate Characterization in Stagnation Point Extensional Flow _____	20
<b><i>PART II: Food, Cosmetics and Pharmaceutical Products</i></b> _____	<b>21</b>
Effect of temperature on the viscoelastic characteristics of San Simón da Costa cheese (PDO) _____	22
Comparative effect of high-pressure and pH on the viscoelastic characteristics of aqueous glucomannan dispersions _____	23

Effect of high pressure on the viscoelastic properties of aqueous glucomannan dispersions	24
Effect of sucrose, stevia and xylitol on rheological properties of gels from blends of chestnut and rice flours	25
Thermorheological behaviour of gluten-free gels from chestnut and rice flours	26
Fat replacement in biscuits by sunflower oil-water-cellulose emulsions. Effect in dough oscillatory and creep properties	27
Flow behaviour of citric flavoured soy desserts. Influence of interaction between protein and starch	28
Effect of high pressure treatment on thermal and rheological properties of chickpea flour dispersions and gels	29
Influence of pH and type of acid anion on the linear viscoelastic properties of egg yolk	30
Influence of the preservative on rheological properties and on in vitro release profiles of topical gels containing AINES	31
Influence of the Lipids in Rheological Characterisation of Amimulsion – a new safe cosmetic emulsion	32
Rheological behavior and structure of food thickeners used for dysphagia treatment when dissolved in water and milk	33
Rheological and kinetic study of the influence of PEG-400 on a Hyaluronic acid polymeric matrix for topical metronidazole administration	34
The influence of a lipid nanoparticle-containing gel on skin viscoelasticity	35
Rheological and microstructural study on food emulsions stabilized by tuna proteins: effect of emulsion pH	36
Rheological characterization of different toothpastes. Analysis of parameters with influence in the packaging process	37
Orientation effects during flow in clay/water suspensions	38
Rheological and texture properties of gels and emulsions prepared with pea protein isolate and proteins recovered from hake by-products	39
Rheological characterization of Chia flour gels for culinary purpose	41
Rheological study on wheat bread dough with Brewer's Spent Grain	42
Texture analysis on wheat bread with Brewer's Spent Grain	43
Rheological characterization of pudding-like barium sulphate-based contrast media for diagnosis of dysphagia	44
Rheology of fine particle size chestnut flour doughs with common bakery additives	45
Dependence on rheological properties of gluten-free doughs with flour processing: effect of temperature and particle load density during air drying	46
Rheological characterisation of fresh like slices of mango purée texturized with gellan gum	47
Rheological behaviour of Probiotics enriched with Medicinal Plants Extracts	48
<b>PART III: Formulation and Product Engineering</b>	<b>49</b>
Rheological behaviour and microstructure of NCO-terminated castor oil bituminous products.	50

Influence of the presence of bicarbonate on the physical and thermal mechanical properties of soy-based plastics processed through injection moulding	51
Relationship between protein-stabilised emulsions properties and controlled emulsification process by a mixer-type rheometer	52
Mixing rheometry of bitumens modified by plastic waste from agriculture	53
Rheological characterization of lubricating greases based on vegetable oil-derived basestocks containing biodegradable and traditional thickeners agents	54
Influence of homogenization rate of O/W emulsions containing a mixture of green solvents and a polyoxyethylene glycerol ester.	55
Thermorheological behaviour of Functional Ionic Liquids	56
Correlations between Mechanical Non Linearity in LAOS and Extrusion Instabilities in Industrial Polyethylenes	57
Rheological Characterization of alpha-pinene multiple emulsions formulated with two amphiphilic copolymers with different HLB and gellan gum	58
Hydrogels of Pluronic F127 in the presence of natural or synthetic polymers	59
Effects of Nanoclay/MDI Polymer-based Modification on Bitumen Properties	60
Rheology, microstructure and stability of limonene in water emulsions stabilized by P9400 and rosin gum. influence of surfactant concentration.	61
Preparation, Rheology and Physical Stability of O/W emulsions formulated with a mixture of green solvents	62
Modification of PVC plasticizers using ionic liquids	63
<b>PART IV: Multiphasic Systems and Composites</b>	<b>65</b>
Rheological behaviour of gel-like dispersions based on organoclay/recycled polypropylene blends and mineral oil for lubricant applications	66
The rheological behavior of concrete equivalent mortars when electric arc furnace slag is used as coarse aggregated	67
Taking advance of dynamic viscoelastic measurements to investigate polyurethane/graphene nanocomposites	68
In-line optical characterization during extrusion of polymer blends	69
Influence of calcium sulfate source on the rheological behaviour of calcium sulfoaluminate cements	70
<b>PART V: Non-Newtonian Fluid Mechanics</b>	<b>71</b>
Practical evidence of the complex steady-state flow behaviour of lubricating greases	72
Torque measurements in Newtonian and non-Newtonian fluids in Taylor-Couette flow	73
Newtonian and non-Newtonian fluid flow in a slowly diverging pipe	74
Visualization of the cell-free layer (CFL) in a PDMS microchannel with a micro-stenosis	75
<b>Flow of Red Blood Cells in Microchannel Networks: in vitro studies</b>	<b>76</b>
Mixing at low Reynolds numbers elastic turbulence in straight microchannels.	77
Elasto-inertial turbulence and the maximum drag reduction asymptote	78

Velocity overshoots in rectangular rectilinear microchannels _____	79
Numerical Investigation of Viscoelastic Instabilities in Taylor-Couette Flow with Counter-Rotating Cylinders _____	80
Numerical simulations of the flow through blood vessels with stenosis _____	81
Numerical studies of flows with non-zero slip yield stress _____	82
Container Filling: Experimental and Numerical studies _____	83
Thermal convection of viscoelastic fluids _____	84
<b>PART VI: Polymers and Liquid Crystals _____</b>	<b>85</b>
Rheological behavior of LMWPE/montmorillonite nanoclays _____	86
When liquid crystalline cellulose flows _____	87
<b>PART VII: Rheometry and Experimental Methods _____</b>	<b>89</b>
Rheology of high yield stress materials _____	90
Using Macro- and Microrheology to Fully Characterize the Dynamic Spectrum and Viscoelastic Properties of Macromolecular Solutions _____	91
Synthesis and rheological characterization of magnetic fluids: influence of the stabilizer agents _____	92
Separation and deformation of red blood cells in PDMS microchannels _____	93
Blood flow in microchannels manufactured by a low cost technique: xurography _____	94
New trends in Rheology and accessories _____	95
The rheological behavior of concrete equivalent mortars _____	96
Assessment of wall-depletion phenomena in dilute multiple emulsions _____	97
Simultaneous Rheometry and FT-IR Spectroscopy or Polarization Light Microscopy _____	98
Flow visualizations in a rotating vane rheometer _____	99
A new concept extending the capabilities of rotational rheometers _____	100
<b>PART VIII: Suspensions and Colloids _____</b>	<b>101</b>
Rheological behavior of water - in - diesel fuel nanoemulsions Stabilized by mixed surfactants _____	102
Core-Shell Structured Microsphere Suspensions and their Electrorheological Characteristics	103
Using fumed silica nano particles in combination with smo conventional surfactant to stabilize w/o highly concentrated emulsion. effect of particle hydrophobicity on rheological properties _____	104
Magnetorheology: on the existence of a true yield stress _____	105
Analysis of the visco-elastic behavior of magnetic fluids _____	106
Core-Shell Structured Microsphere Suspensions and Their Electrorheological Characteristics	107
Scouting the rheology of aqueous dispersions of a food-grade advanced performance xanthan gum _____	108
Unusual rheological behavior of the clay aqueous dispersions in the presence/absence of poly(ethylene oxide) _____	109

<b>Rheology of ethylene glycol based TiO<sub>2</sub> (anatase and rutile) nanofluids at high concentrations</b>	<b>110</b>
<b><i>Author Index</i></b>	<b>111</b>

## **PART V**

### **Non-Newtonian Fluid Mechanics**

## Flow of Red Blood Cells in Microchannel Networks: in vitro studies

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Blood exhibits unique flow characteristics on micro-scale level, due to the complex biochemical structure of Red Blood Cells (RBCs) and their response to both shear and extensional flow, which influence the rheological properties and flow behavior of blood [1,2]. In the past years, several in vitro studies were made and have revealed some physiologically significant phenomena, such as Fahraeus and Fahraeus-Lindqvist effect, that played a key role in recent developments of lab-on-chip devices for blood sampling, analysis and cell culturing [1,3]. However, the blood flow in microvascular networks phenomena it remains incompletely understood. Thus, it is important to investigate in detail the behavior of RBCs flow occurring at a microchannel network, such as with divergent and convergent bifurcations. Previous in vitro studies in microchannels with a simple divergent and convergent bifurcation, have shown a pronounced cell depleted zone immediately downstream of the apex of the convergent bifurcation [1,4]. In the present work, by using a high-speed video microscopy system, we investigated the cell depleted zone in a microchannel network. The working fluid used in this study was dextran 40 (Dx40) containing about 10% of haematocrit level (10 Hct) of ovine red blood cells. The high-speed video microscopy system used in our experiments consists of an inverted microscope (IX71, Olympus, Japan) combined with a high-speed camera (i-SPEED LT, Olympus). A syringe pump Apparatus (PHD ULTRATM) with 1 ml syringe (Terumo) was used to push the working fluids through the microchannel network. Additionally, we investigated the effect of the flow rate on the formation of the cell free layer.

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