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Rheology and restart flow: a comparative characterization of xanthan gum and glycerin formulations

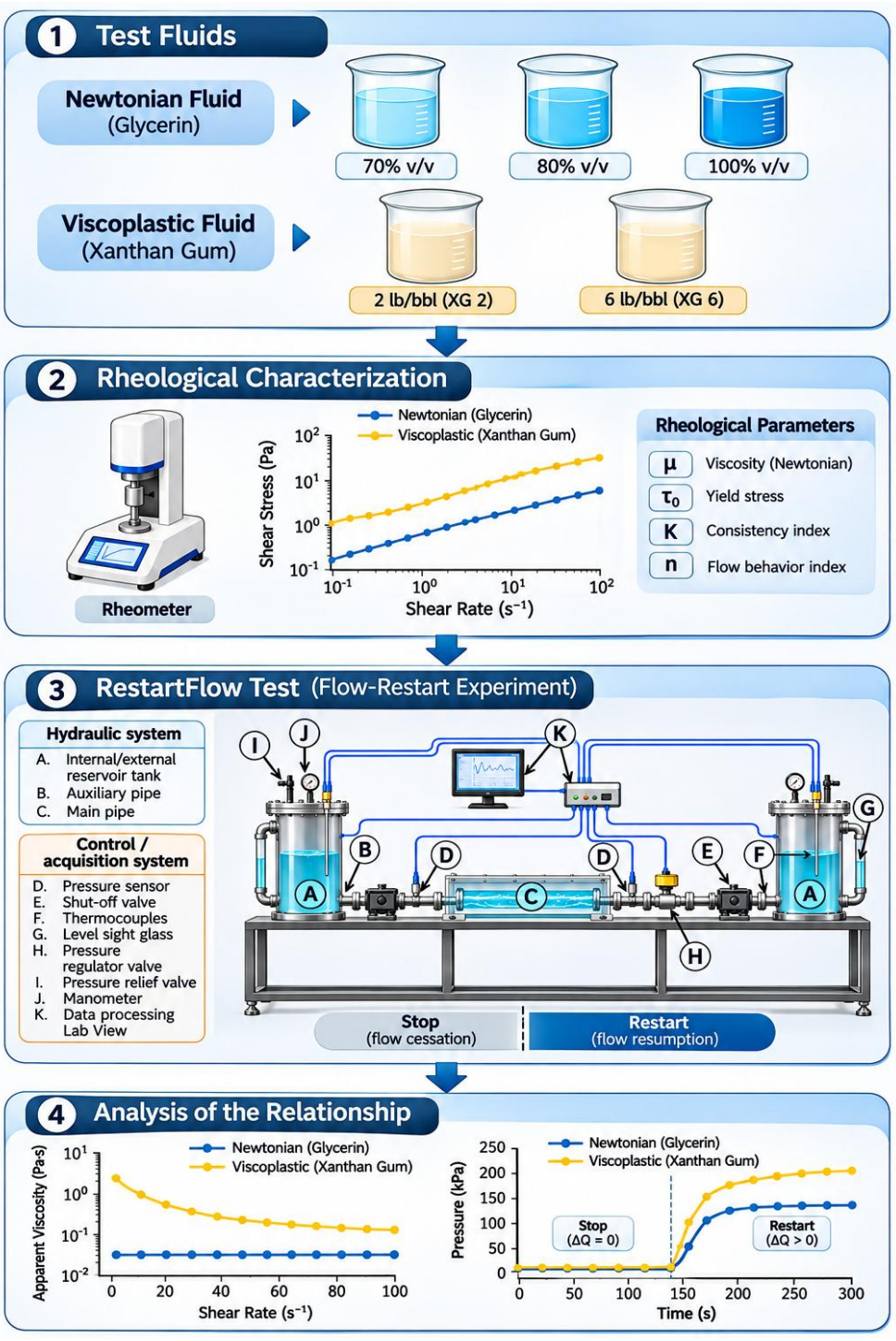
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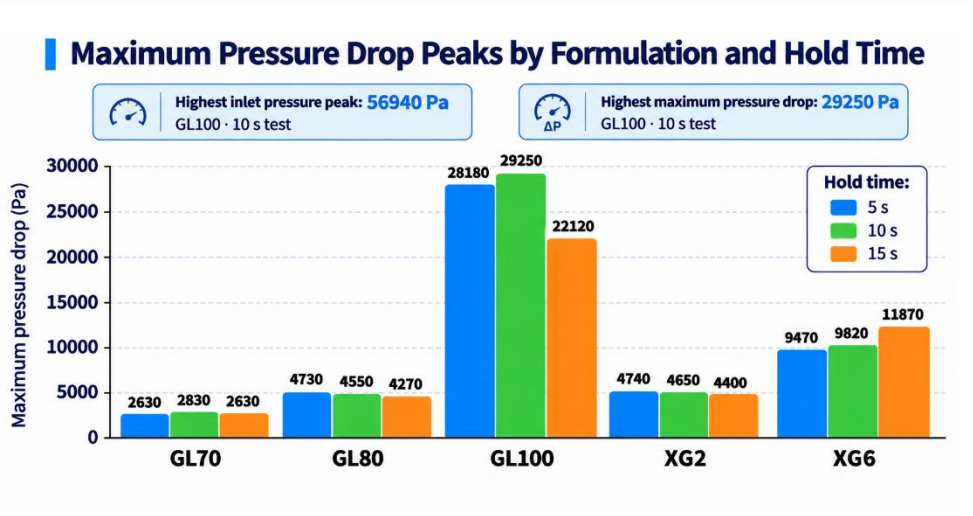
Introduction and objectives

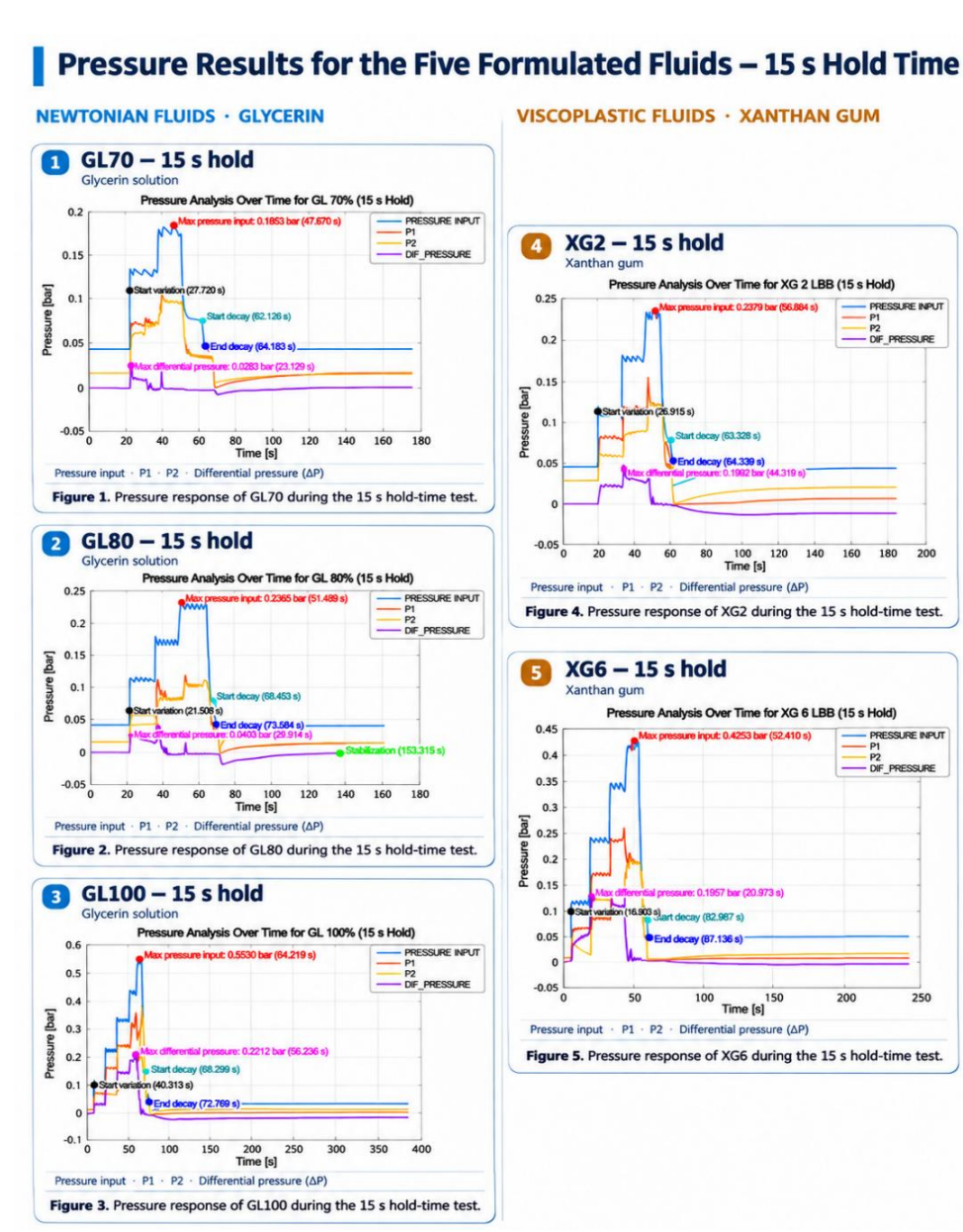
Flow restart in pipelines produces transient pressure surges that depend strongly on fluid rheology (Tikariha & Kumar, 2021). While Newtonian fluids are primarily governed by viscosity, viscoplastic fluids exhibit additional resistance due to yield stress and shear-thinning behavior (N'Gouamba et al., 2021). The main challenge is understanding how these rheological properties affect pressure transmission and flow re-establishment (Rivera Jimenez, 2021). Experimental characterization is therefore essential to relate fluid behavior to transient pressure responses.

Analyze the relationship between Newtonian and viscoplastic rheology and pressure transmission during RestartFlow start-up tests.

Methodology







Results and Discussion

Newtonian reference | mean viscosity, μ (Pa·s)

GL70	GL80	GL100
0.01963	0.05788	0.69550

Viscoplastic rheology | Herschel–Bulkley fit

$\tau = \tau_0 + K\,\dot{\gamma}^n$ (τ_0: Pa; K: Pa·s^n; n: dimensionless)

Fluid	τ_0 (Pa)	K	n	R^2
XG 2	5.703	0.3600	0.5511	0.99908
XG 6	25.305	2.2570	0.4603	0.99948

Conclusions

1. Fluid rheology strongly influences differential-pressure development during flow restart.
2. XG6 exhibited greater viscoplastic resistance than XG2, with higher yield stress, consistency index, and pressure peaks.
3. Further studies, including creep tests, oscillatory rheology, and flow visualization, are needed to clarify restart mechanisms.

Acknowledgments

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