

## Low-Toxicity Ionic Liquids as Additives for Environmentally-Friendly Lubricants<sup>#</sup>

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### Abstract

In this study, low-toxicity ionic liquids (ILs) are being developed as potential additives for environmentally friendly lubricants (EALs), specifically for hydraulics. Candidate ILs were designed and synthesized based on Lubricant Substance Classification list (LuSC-list) and then screened by their oil solubility and corrosivity. Selected ILs were blended at 0.5% concentration into a polyalkylene glycol (PAG), an oil soluble PAG (OSP), and a mineral base oil and their tribological performance was tested under boundary lubrication of steel-steel sliding. Several ILs exhibited superior friction and wear behavior to the traditional ZDDP, particularly when used in the PAG and OSP. This suggests better compatibility of the ILs with polar oils, which was later confirmed by tribofilm characterization. Acute and chronic toxicity tests that exposed *Ceriodaphnia dubia*, a common aquatic bioindicator species, demonstrated that selected candidate ILs are significantly less toxic than ZDDP. This work opens new avenues for developing ILs for EALs.

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