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Inspiring process innovation via an improved green manufacturing metric: iGAL

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Green chemistry is critical for balancing sustainability of business, society, and environment. It helps in stimulating scientific innovation, lowers development and manufacturing costs and reduces environmental footprint. However, its full potential for drug manufacturing has been inhibited by lack of metrics standardization, inconsistent analysis, and disregard for molecular complexity. Recognizing the need for a metric that will not only enable better measurement of "greenness" but also encourage innovation of greener processes, twelve large pharmaceutical firms from the IQ Consortium's Green Chemistry working group and the ACS Green Chemistry Institute Pharmaceutical Roundtable, joined efforts with Professors Roger Sheldon (the inventor of the E factor) and Paul Anastas (the "father" of green chemistry). The team developed the critically needed and unified green manufacturing measure, the innovation Green Aspiration Level (iGAL). To identify elements critical to evaluating "greenness" and encouraging greener processes, the team performed a statistical analysis of 64 drug manufacturing processes. We observed that iGAL afforded an excellent proxy for molecular complexity and presented a valuable molecular weight-based 'fixed' goal, thereby it is accurately capturing the impact of green process inventiveness and improvements, rendering it a useful innovation-driven green metric. By creating the iGAL, we accomplished its goal to devise a unified green chemistry metric that inspires innovation in drug manufacturing across the industry. iGAL is easy to use, with calculations to determining Relative Process Greenness (RPG) requiring minutes once the process waste has been determined. By being a fixed goal, iGAL enables full recognition of process innovation via RPG improvements and thus establishes itself as a key link between green chemistry innovation and inspired environmental waste reduction efforts. We believe this relationship, coupled with the graphically appealing Green Chemistry Innovation Scorecard as a communication tool, will encourage broad adoption within the pharmaceutical and allied industries.

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