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The global metal demand is steadily growing for both industrial and domestic applications, and is anticipated to increase by 30% by 2050[1]. Combined to high-grade deposits exhaustion, it motivates the exploitation of low-grade ores. Within this context, bioleaching represents an alternative when traditional processes are not economically viable.

An innovative bioleaching concept was recently developed, using floating agitators to inject gases and to mix solids in ponds instead of costly tanks[2,3]. Based on an oxygen-enriched air, the gas-liquid transfer is improved, and the temperature, crucial to "regulate" the exothermic biological reactions ($\Delta r H^0$ = -12.9 MJ kg^{-1} for pyrite oxidation), can be controlled without heat exchanger[4]. This system was validated at pilot scale (2 m^3 reactor with mini-floating agitator 1:4-scale at a culture temperature of 40 °C using a moderate thermophilic consortium)[5], and a scale-up method was elaborated for the industrial scale (>10^3 m^3). The process design was based on a complete heat balance, including bio-chemical reactions, agitator power input and both solar and atmospheric radiation for heat gains. For heat losses, radiative emission, aeration, pond wall convection, pond surface convection and evaporation were considered. A dynamic integration was performed using weather data near the Sotkamo mine (Finland), regarding day / night and season impacts. Impacts of pond dimensions and gas inlet flowrates were finally investigated in order to propose enhanced geometries and operating conditions, regarding efficiency of the bioleaching reactions.

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- [x] Oral contribution
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