A FAST hydrogenation platform for nitroreductions

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Continuous manufacturing can offer a number of process improvements including faster reactions, increased safety, access to challenging reactions, improved product quality and often requires a smaller footprint.[1] The purpose of Almac's Flow Assisted Synthesis Technology (FAST) platform is to provide the best available technology to match our customers' demanding processing needs today, tomorrow and in the future. This presentation will showcase real-life projects where flow chemistry has been used as an innovative technology from proof of concept (PoC) through to manufacture.

Flow hydrogenation offers increased safety due to small dosage of hydrogen (*via in situ* generation/mass flow controller), improved temperature control, smaller solvent volumes and also improved outcomes due to enhanced gas-liquid-solid mass transfer, stringent control, reduced side products and the necessity for minimal purification. A continuous flow packed-bed reactor has been developed for the hydrogenation of aromatic nitrobenzoic acids in water to produce the corresponding anilines (Figure 1).[2] These hydrogenations are green, more efficient, less consumptive and safer reductive processes. The technology has been demonstrated to afford various industrially important aromatic amines in excellent yields and with high throughput. Critically, the FAST hydrogenation produced no detectable Genotoxic Impurity (GTI) intermediates in comparison with the batch mediated reduction. The reactor is modular in design and can be scaled to multi-kg/day product delivery without extensive redesign and currently a larger (100 kg/week) rig is under construction.

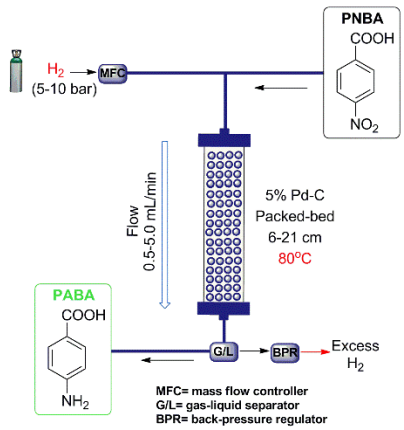

Figure 1: FAST hydrogenation of PNBA to PABA.[4]

References:

1. M. Baumann, T. S. Moody, M. Smyth and S. Wharry, *Org. Process Res. Dev.*, **2020**, *Accepted, Ahead of print*.

2. MD T. Rahman, H. Manyar, T. S. Moody, M. Smyth and S. Wharry **2020**, Synlett *Accepted, Ahead of Print*.