

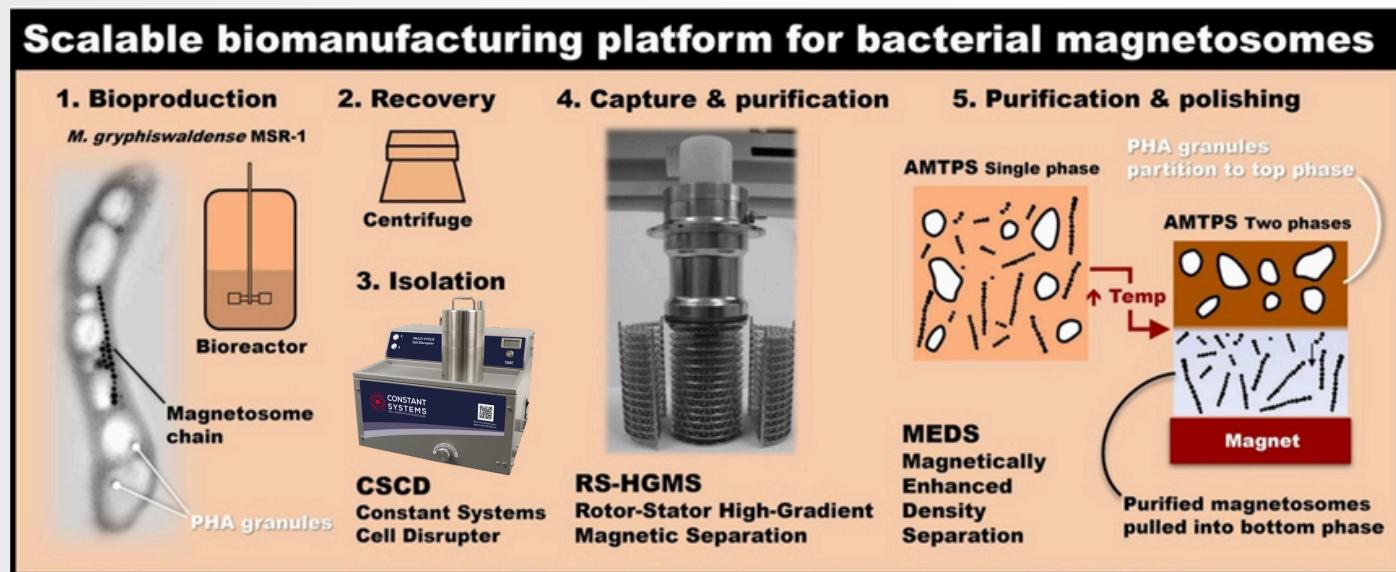
## Application Note

# A scalable biomanufacturing platform for bacterial magnetosomes

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## Introduction

An integrated scalable platform for fermentative production and downstream processing of bacterial magnetosome products is advanced. Long magnetosome chains, high cellular magnetism, and low numbers of polyhydroxyalkanoate granules were obtained during the exponential growth phase of a two-stage continuous high cell density fermentation of *M. gryphiswaldense* MSR-1. Centrifugally concentrated 20% (w/v) suspensions of exponential phase cells were disrupted with high efficiency (92%) in a single pass through a Constant Systems Cell Disruptor operated at 10 kpsi, releasing 75% of the cellular iron. Magnetosomes were recovered in partially purified form from crude whole cell disruptates by rotor-stator high-gradient magnetic separation.



Further purification/polishing was achieved by magnetically enhanced density separation in an aqueous micellar two-phase system (a new technique developed in this work as a low-cost alternative to sucrose gradient ultracentrifugation). The unoptimised 4-step process delivered highly purified magnetosomes (ca. 50 and 80-fold with respect to polyhydroxyalkanoate and protein) in > 50% yield, with no evidence of crystal coat damage, acceptable reduction (35%) in median magnetosome chain length, and magnetic properties (pot-bellied hysteresis loop, coercivity = 9.8 mT, 'squareness' = 0.32) expected of isolated magnetosome chains. Though demonstrated in batch mode, the platform displays potential for end-to-end continuous manufacture of future magnetosome-based products.

## About The Multi Cycle Cell Disrupter

The MC Cell Disrupter is the most versatile model for small volume processing offered by Constant Systems Limited. At approximately 500mm<sup>2</sup> the MC sits very comfortable on the benchtop but is best suited when used on its tailor made trolley.

The MC trolley ensures that the equipment is situated at its optimum working height and is mounted on full swivel and lockable casters that enables safe and free movement of the equipment when needed.

The MC is capable of processing volumes from 0.5mL to 40mL per process and is recommended for volumes up to 80mL which makes the MC ideal for those users who wish to upgrade from small bench-top techniques such as bead beating and sonication. The MC takes advantage of Constant Systems precise and consistent hydraulic control which is fully scalable through the whole product range from 0.5mL single preparation processing to large volume processing at 150L per hour.

This precise control ensures that the entire sample is processed at the operators set pressure to ensure accurate and consistent results and in most cases a single process or pass is adequate therefore multiple passes are not required. The MC model can be utilised in three modes, these being Single Cycle (SC), Multi Cycle (MC) and Re Cycle (RC) for processing fluid, viscous, tissue, plant and frozen sample types.

SC Mode is simply a single cycle process and can be utilised to process 0.5mL – 8mL volumes of all sample types whether fluid, solid, frozen, tissue or plant.

MC Mode can be utilised to process greater than 8mL volumes up to 40mL in each process and recommended for a total volume no greater than 80mL. In MC mode all sample types that are fluid and re-suspended can be processed.

RC Mode enables the user to conduct multiple passes of the same sample (fluid or re-suspended) without collecting and reintroducing the sample time and time again. RC mode is best utilised for very tough sample types such as Gram Positive Bacteria and some Fungi and Algae types. In RC mode a maximum sample volume of up to 80mL can be processed.