2022 MELISSA CONFERENCE
8-9-10 NOVEMBER 2022

CREATING A CIRCULAR **FUTURE**

Assessing the integration of a bioreactor producing SCPs and PHAs from organic waste into global environmental systems

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In coordination with ***Pierre Joris*** *(TBI PHD student)*

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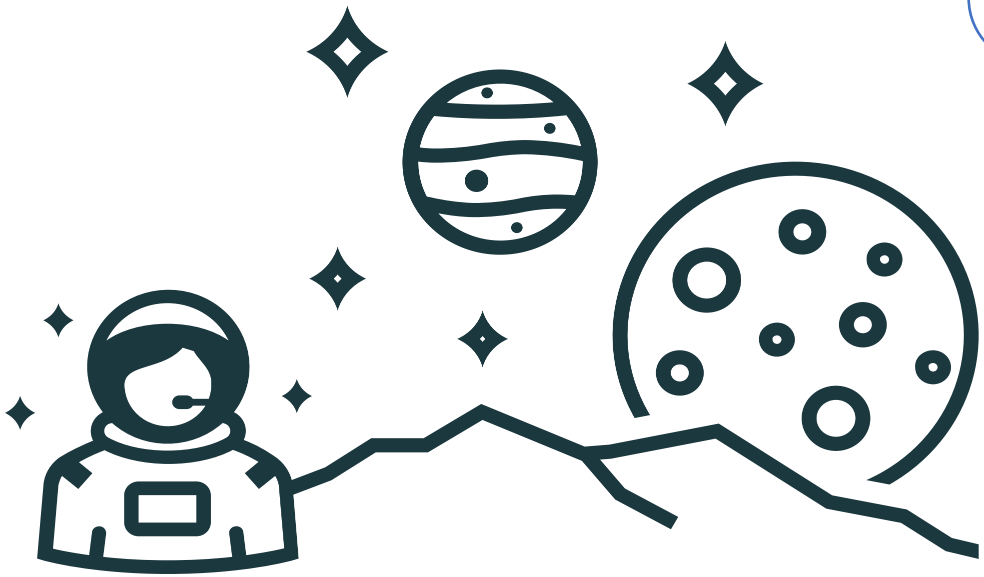
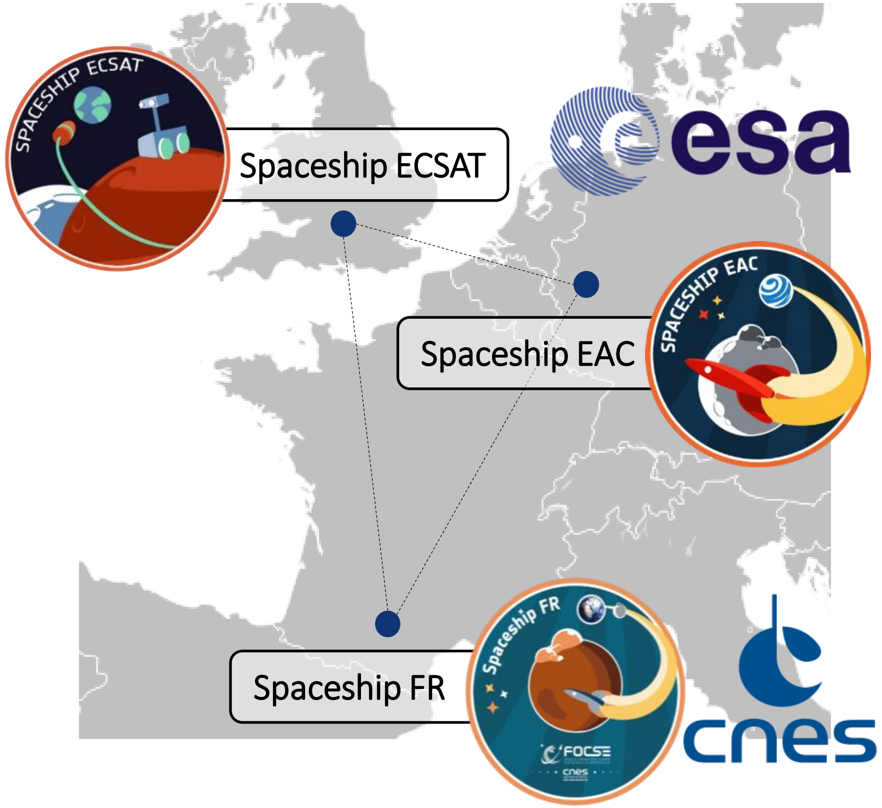


I. SPACESHIPS PROJECTS & CONTEXT



II. BIOREACTOR CONCEPT

N2 (% air)	O2 (% air)	CO2 (% air)
77,7	21,3	0,009

O_2
rO2 = - 12 mmol/L/h

CO_2 (to be valued)
rCO2 = 7,9 Cmmol/L/h

N2 (% air)	O2 (% air)	CO2 (% air)
78,2	19,0	1,9

INLET

Nitrogen source (urea)
rN = - 1,6 Nmmol/L/h

Carbon source (VFA mix)
rC = - 13 Cmmol/L/h

Biomass
Qx = 0,17gDM/L/h

(72% of proteins)
Qp = 0,12gProteins/L/h

OUTLET

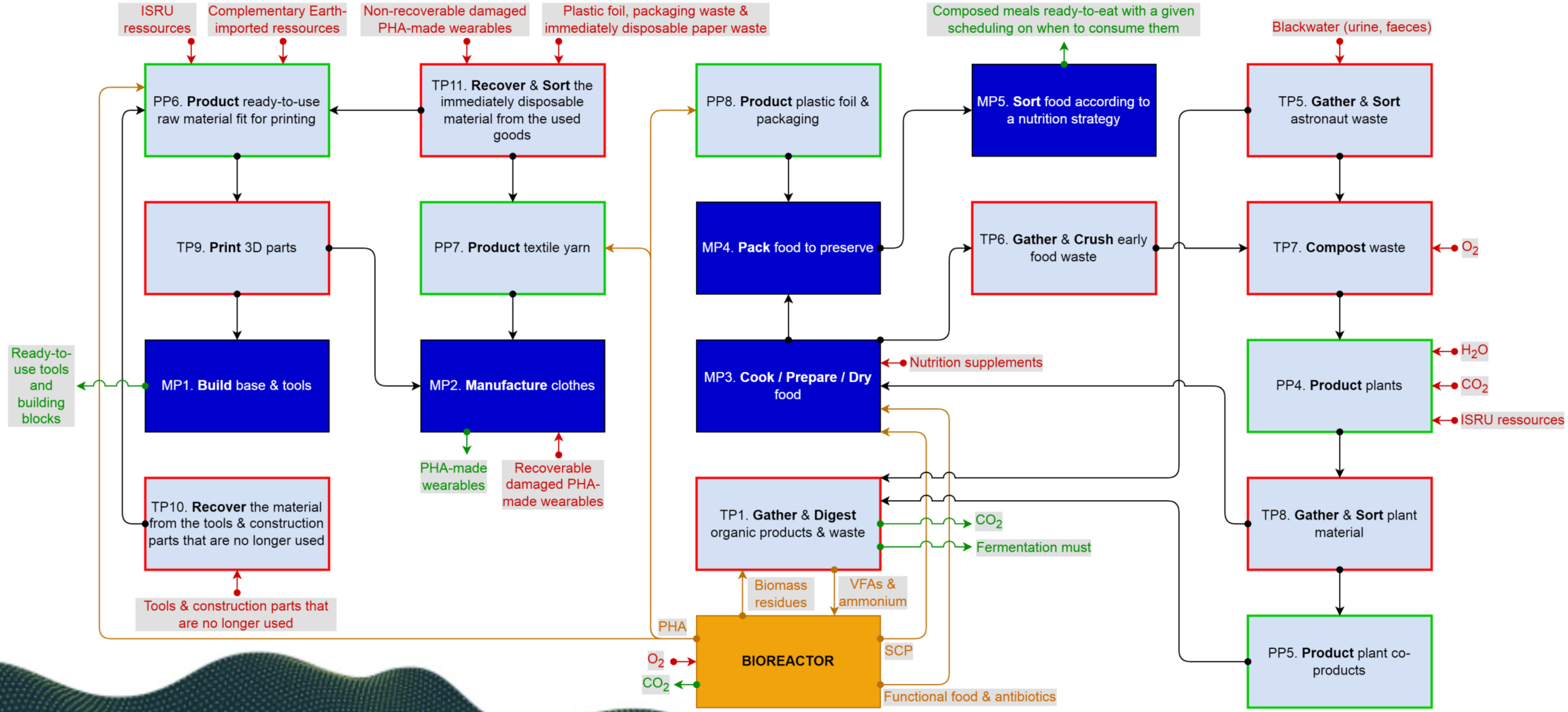
Input concentrations & C/N ratio

Nitrogen (Nmol/L)	Carbon (Cmol/L)	C/N
0,041	0,212	8,1

SCPs production mode
(study case for D=0,06 h^{-1})

** Credits & results from INSA TBI, CNRS, INRA, Pierre Joris*
** For more information see Pierre Joris presentation on 10/11 at 13:30 Room 1 on the topic of "Assessing the Recycling Potential of Cupriavidus necator for Space Travel: Production of SCPs and PHAs from Organic Waste."*

III. BIOREACTOR INTEGRATION INTO SPACESHIP FR ROADMAP



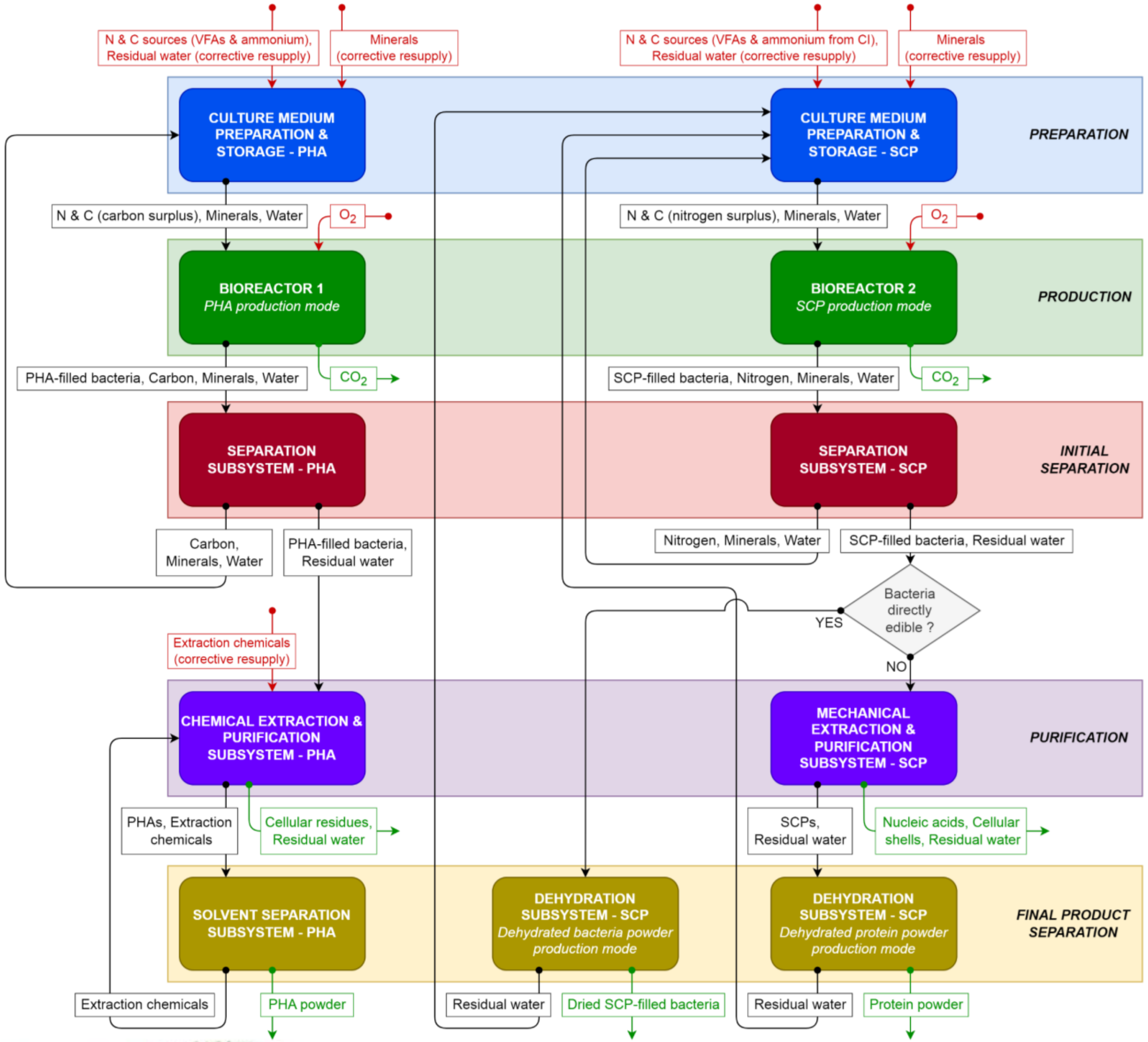
* *For more information see Grégory Navarro presentation on 09/11 at 11:30 Room 3 on the topic of " SpaceShip FR and MELiSSA : Harmonized Roadmaps for Regenerative Life Support Systems"*

IV. BIOREACTOR PRODUCTION CONFIGURATIONS

MULTI REACTOR **EXCLUSIVE** PRODUCTION CONFIGURATION *(uninterrupted production)*

SOLO REACTOR **INCLUSIVE** PRODUCTION CONFIGURATION *(uninterrupted production)*

SOLO REACTOR **EXCLUSIVE** PRODUCTION CONFIGURATION *(batches production)*



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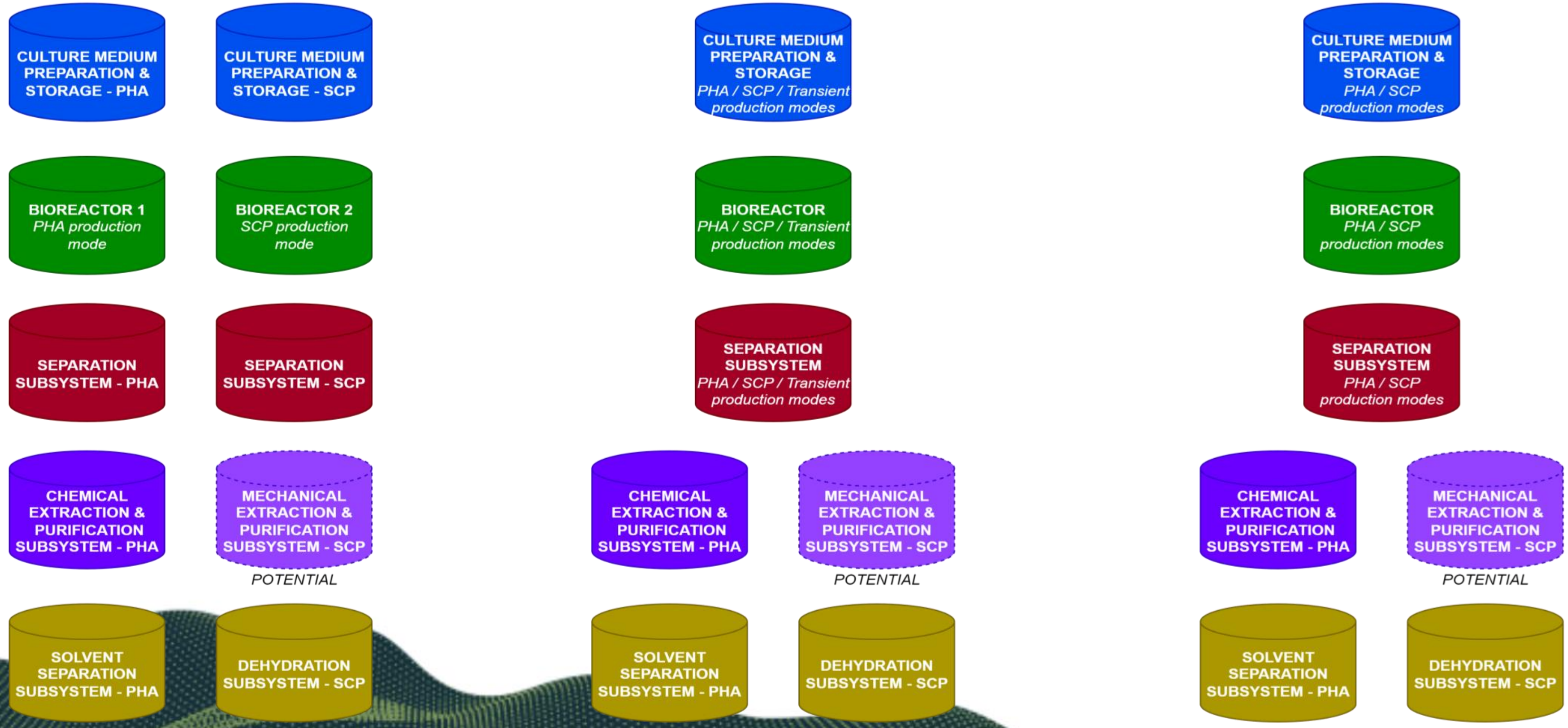
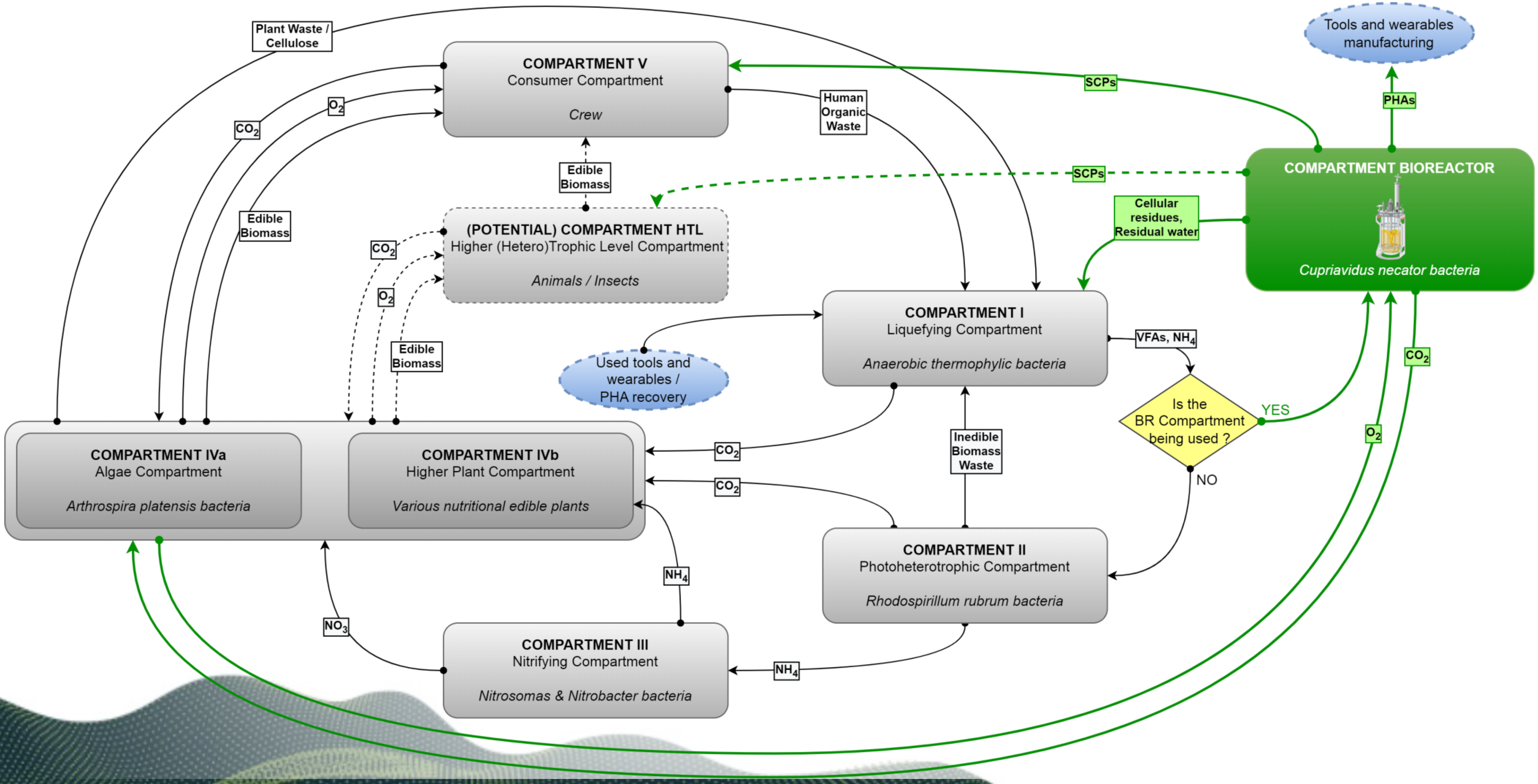


V. BIOREACTOR POTENTIAL INTEGRATION INTO THE MELISSA LOOP



V. BIOREACTOR POTENTIAL INTEGRATION INTO THE MELISSA LOOP

MAIN ADVANTAGES OF A POTENTIAL INTEGRATION OF THE BIOREACTOR INTO THE MELISSA LOOP	OPENINGS TO BE STUDIED AND FUTURE STEPS TO BE UNDERTAKEN
• The production of PHAs allows for the manufacture of goods with a certain degree of autonomy from possible carbon surpluses • The production of SCPs allows both to guarantee a good supply of proteins and also to eventually ensure a food chain of interest • The production of SCPs, although not essential, makes it possible to diversify the nutritional intake and the dishes of the crew.	• Production of functional food and antibiotics to allow safety margins in terms of access to care and health prevention • To adapt the bioreactor so that it can function properly in the space environment • To look at the possibilities of improvements to optimise the comfort and durability of tools and wearables made from PHAs • To further evaluate the amount of energy and material resources that the bioreactor system would draw from the Melissa loop

MELISSA MICRO-ECOLOGICAL LIFE SUPPORT SYSTEM ALTERNATIVE

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