Assessing the Carbon Impact Related to the Production of Anticancer Drugs in Isolator and Automated Chemotherapy Preparation Robot

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Context

Healthcare activities ⟶ significant emitter of greenhouse gases (CO_2 +++) ⟶ **global warming**

Emergence of automation system for chemotherapy compounding offering many benefits

This study aims to evaluate the CO_2 equivalents (CO_2e) emitted related to the preparation of an anticancer drugs using an isolator (manual preparation) and a robot (automated preparation with Apoteca® by Loccioni)

Material and Method

Standardized production of 500mg Rituximab in 250mL infusion bags

Calculations based on campaigns of 7 preparations, then extrapolated to estimate annual production

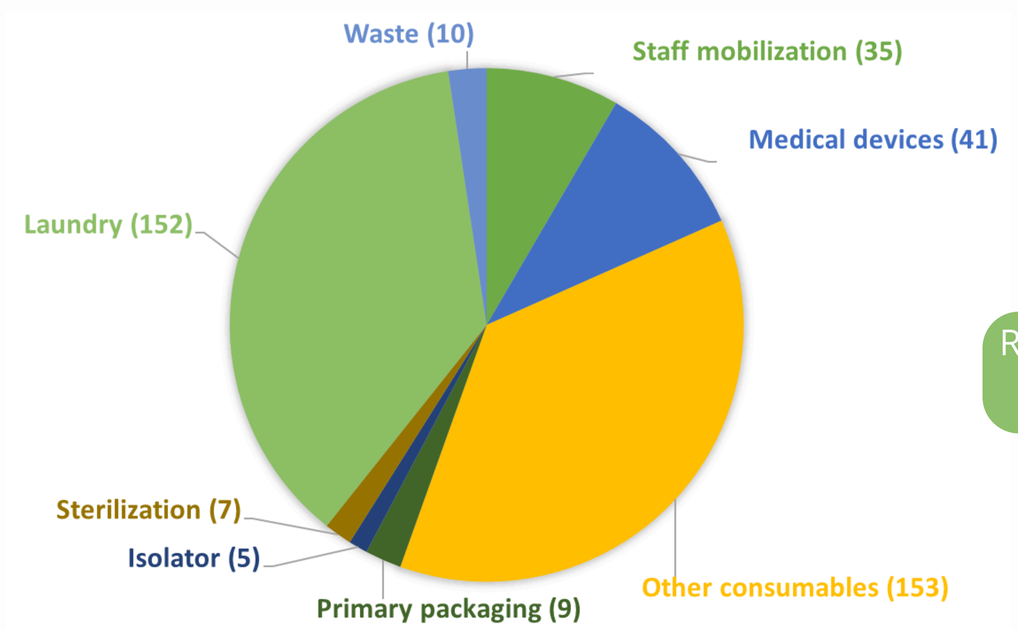
Analysis includes **resources used** and **products consumed**

Data collection : product weighting, information from manufacturers and service providers, literature

Data converted into CO_2 equivalents using the public databases ***CareBone®*** (Paris Hospital) and ***Empreinte®*** (French Agency for Ecological Transition)

Total uncertainty was calculated by factoring in uncertainties related to emission factors and activity data, weighted by carbon emissions of each category

Results

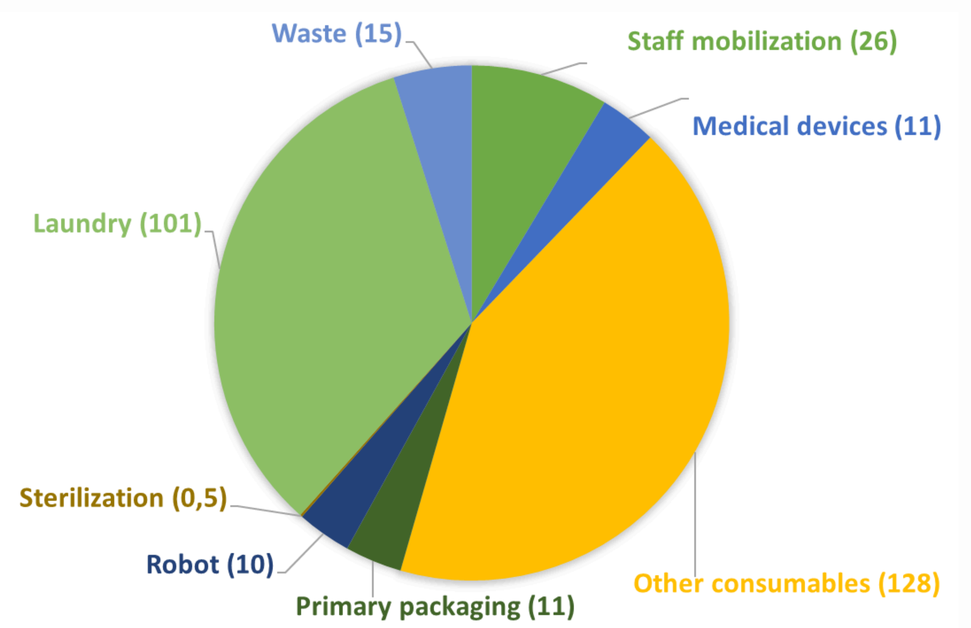


Distribution of carbon emission sources using the isolator
(all numbers are in kgCO2e)

315 preparations

Relative difference = 0,43%

Uncertainty = 64%



Distribution of carbon emission sources using the robot
(all numbers are in kgCO2e)

Medication supply chain :

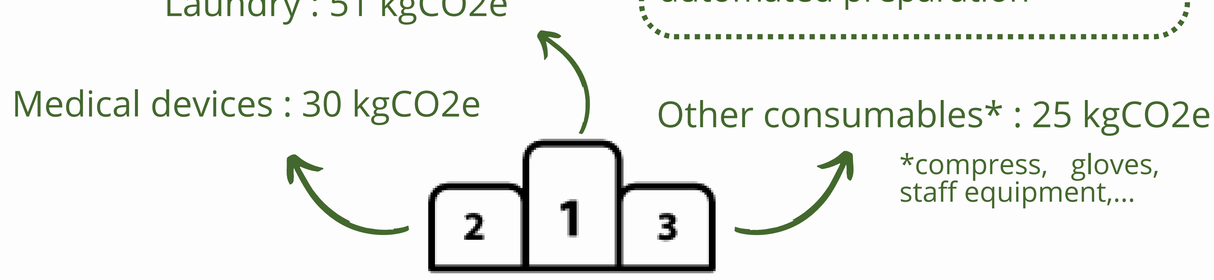
- Rituximab 500mg/50mL = **25 275 kgCO2e**
- Sodium chloride 0,9% 250mL = **91 kgCO2e**

	Isolator	**Robot (Apoteca® by Loccioni)**
Resources used	199 kgCO2e	137.5 kgCO2e
Products consumed	25 579 kgCO2e	25 531 kgCO2e
Total	25 778 kgCO2e	25 668.5 kgCO2e

Carbon emissions of the two production methods

Explanations :

Manual preparation required one more operator than automated preparation



Main absolute differences in carbon emissions between the two production methods

Conclusion

Both production methods result in nearly identical carbon emissions (**relative difference = 0,43%**)

The most effective strategy for reducing the carbon footprint, beyond the choice between manual or automated production, lies in **conducting production through campaigns**, minimizing consumable use

Limitation

Use of monetary factor to convert Rituximab into CO_2 equivalents instead of a factor based on **Life Cycle Assessment** (LCA)

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