Unveiling the Potentials of the plant Panicum maximum in vertical subsurface flow constructed wetland in a humid urban sub-Saharan environment

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PLAN OF THE PRESENTATION

- **INTRODUCTION**
- **MATERIALS AND METHODS**
- **RESULTS AND DISCUSSION**
- **CONCLUSION AND RECOMMENDATIONS**

INTRODUCTION

- ❑Some authors have investigated urban wastewater, artificial wetlands, industrial effluents and agricultural waste (Fonkou et al., 2010; Soh et al., 2014),
- ❑Wastewater pollution by heavy metals still remains a problem to be solved despite these traditional methods,
- ❑Constructed wetlands vegetated with local macrophytes, are today becoming an interesting alternative for the treatment of wastewater at low cost (Malaval et al., 2016),
- ❑Therefore, this work contributed to the application of phytotechnologies for the purification of wastewater by local macrophytes in Ebolowa South Cameroon.

MATERIALS AND METHODS

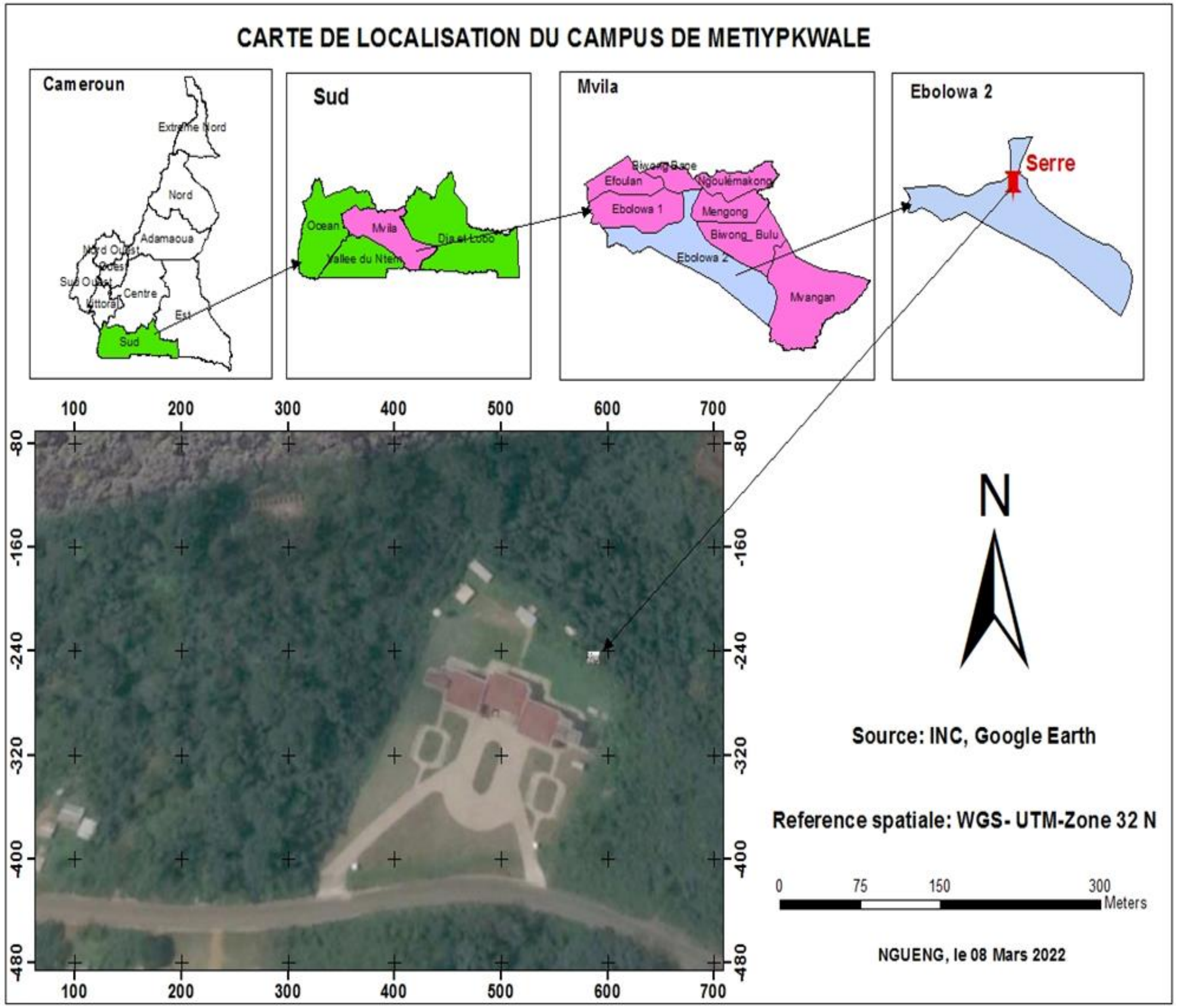
Study area

- Cameroon is located in Sub-Saharan Africa between West and Central Africa at the extreme North Eastern end of the Gulf of Guinea. It lies between latitudes 2° and 13° North of the equator and between longitude 8° and 16° east of the Greenwich Meridian

- It has a total surface area of 475,650 km^2 with a mainland surface area of 466,050 km^2 and a maritime surface area of 9,600 km^2; respectively (NIS 2001)

- The estimated population is 27 million (WHO & UNICEF 2021)

- The rate of access to drinking water is 66% while that of sanitation is 45% (WHO & UNICEF 2021).



MATERIALS AND METHODS

Experimental set up and operation conditions

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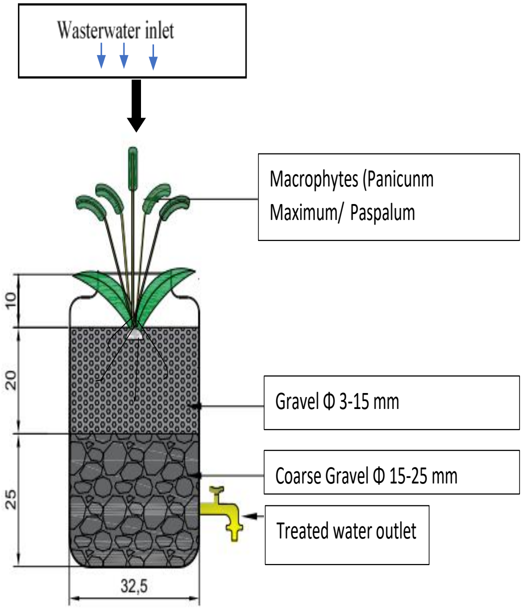
- Testing of subvertical flow constructed wetlands microcosm reactors (6 and 2 control), Treating artificial wastewater polluted with Ni in green house;
- 03 reactors vegetated with *Panicum Maximum* 03 planted with *Paspalum polystachyum* and 02 unplanted reactors (controls)

- Wasterwater inlet: From Ni powder ($NiSO_4,6H_2O$), solutions of concentration 0.5 and 1 ppm were prepared in the lab;

- Irrigation of reactors with artificial Ni polluted water: Groundwater was used in 15 L to prepare the amount of each irrigation. Interval: 20 days.
- Wastewater sampling: triplicate samples for each reactor before any irrigation within 3 months in plastic bottles (250 mL) previously sterilized with chloridric acid.
- Lab analysis: Ni concentrations using Atomic Absorption Spectrophotometer (AAS) after calibration of the device with standard solutions.



RESULTS AND DISCUSSION

Inlet and outlet concentrations of wasters in reactors

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- Inlet concentrations: [0,502±0,023; 1,191±0,003] mg/L
- The output concentrations in the unplanted system : 0.046 mg/l compare to planted bed with *Panicum Maximum* : 0.044 mg/ l and,
- 0.043 mg/l for the system planted with *Paspalum polystachyum* as:
- All outlet concentrations were <0.2mg/l (WHO admissible level). These observations differ from Defo et al. (2017) testing Ni removal in VSSF CW planted with Typha, Arundo and Vetiver.

Ni 1,194mg/l				
Periods	Inlet Concentration (mg/l)	Outlet concentration (mg/l)		
		Pm	pp	C
April	1,191±0,003	0,027±0,010	0,041±0,006	0,047±0,001
	Ni 0,538 mg/l			
May	0,526±0,045	0,026±0,007	0,041±0,001	0,045±0,002
	Ni 0,538mg/l			
June	0,502±0,023	0,027±0,003	0,037±0,005	0,0,049±0,0001

Pm : Panicum maximum : Paspalum polystachyum and C : Control

RESULTS AND DISCUSSION

Concentrations of Ni absorbed in plants

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- Phytoextraction of Ni happened and Ni Was stored in the roots of plants
- No storage in the steams
- Defo et al. (2017) different findings for *Typha, Arundo* and *Vetiver*, where Ni was stored in roots and steams of plants in VSSF CW

	PLANT ANALYSIS			
Period		Ni Concentrations (mg/kg)		
	Pm		*pp*	
	Roots	Steam	Root	Steam
April	0,666	0	0,497	0
May	0,277	0	0,219	0
June	0,308	0	0,205	0

Pm : *Panicum maximum*, *pp* : *Paspalum polystachyum*

RESULTS AND DISCUSSION

Performances of macrophytes studied compared to controls

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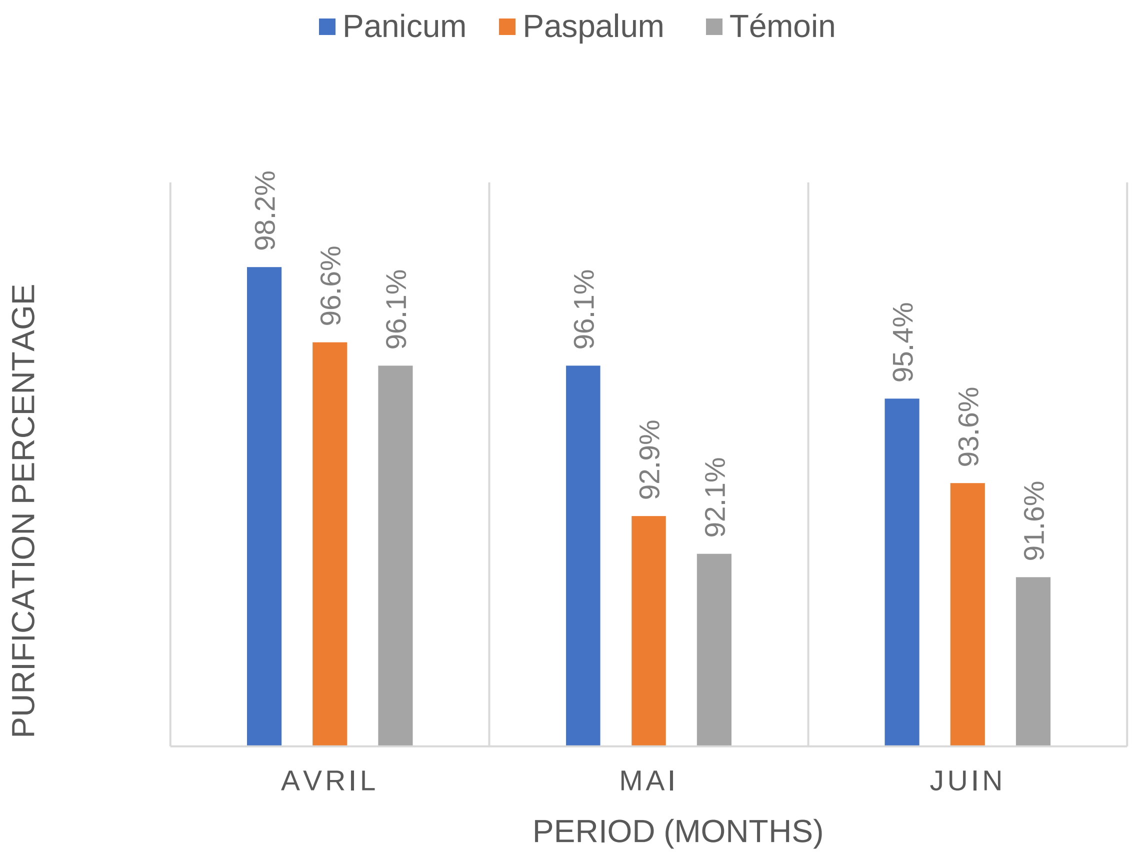
- Superior efficacy of planted beds compared to control beds, attributing this enhancement to the presence of vegetation.
- The unplanted system had a purification performance of 94.0%, while the system planted with *Panicum Maximum* was 92.5% and 93.3% for the system planted with *Paspalum polystachyum*.
- The statistical analysis revealed that there was no significant difference between the purification performances of the two tested plants (pvalue < 0.05).
- These plants showed better performance compared to those tested by Paritosh et al. (2019), Defo and Kaur (2018).



RESULTS AND DISCUSSION

Plant growth evolution in the tested reactors

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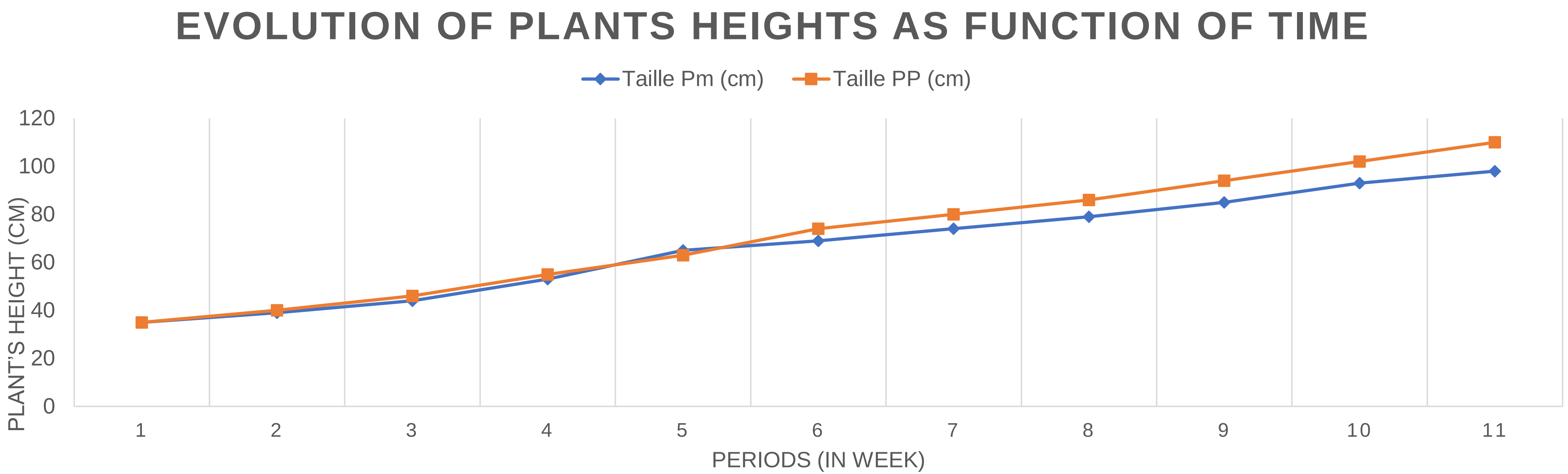

Pm : *Panicum maximum, pp* : *Paspalum polystachyum*

CONCLUSION

- The vertical flow system produced in the reactors is a system with good purifying performance, as well as the selected macrophytes.

- The Planted reactors showed better performences compared to control (unplanted).

- The system planted in *M. Panicum* eliminates more than that planted in *P. Paspalum* and that of the control. The purifying performances are 96.6% for the system planted with *P. Panicum*, 94.4% for *P. Paspalum* and that of the control is 93.3%.

- Finally there was no significant difference between the purifying performances of the different systems.

Thank You

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