

**3RD INTERNATIONAL  
CONFERENCE  
on Sustainable Solid  
Waste Management**

**Biogas production from algae biomass  
from municipal wastewater treatment**

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## ***EGAR - Environmental and Geo Applied Technological Research***

- ✓ new wastewater and water treatment technologies*
- ✓ solid waste management*
- ✓ thermal and microclimatic properties of buildings and structures;*
- ✓ energy, ecological and sustainable conception of municipal and regional development;*
- ✓ geodetic support in construction and research;*
- ✓ diagnostics of foundation conditions;*

# Content

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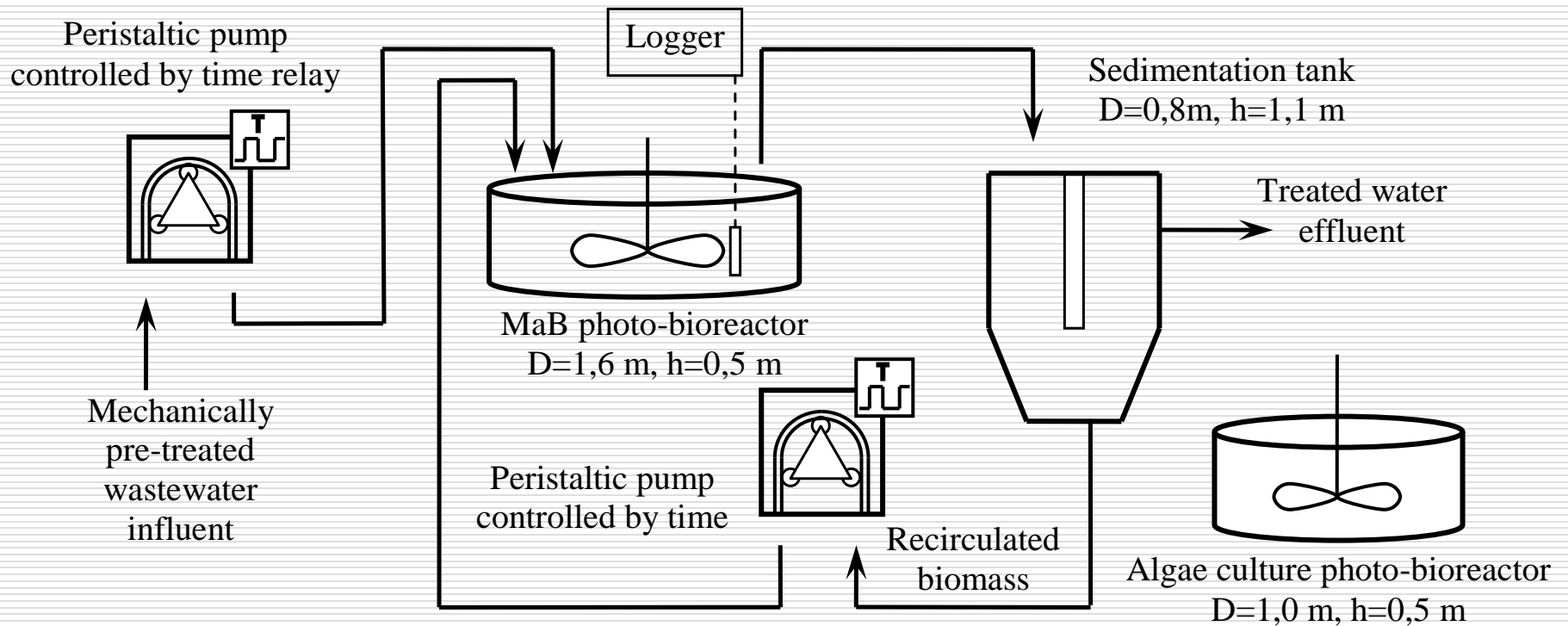
- Introduction
- Materials and methods
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- Conclusions

# Introduction

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- Microalgae have the ability to fix carbon dioxide, nutrients and store the solar energy into their cells via photosynthesis which makes them interesting as an alternative energy source and for wastewater treatment.
- Compared to the conventional technologies for green fuel production, microalgae have higher growth rates and their growth does not compete with crops for human or animal nutrition.

# Scheme of pilot plant



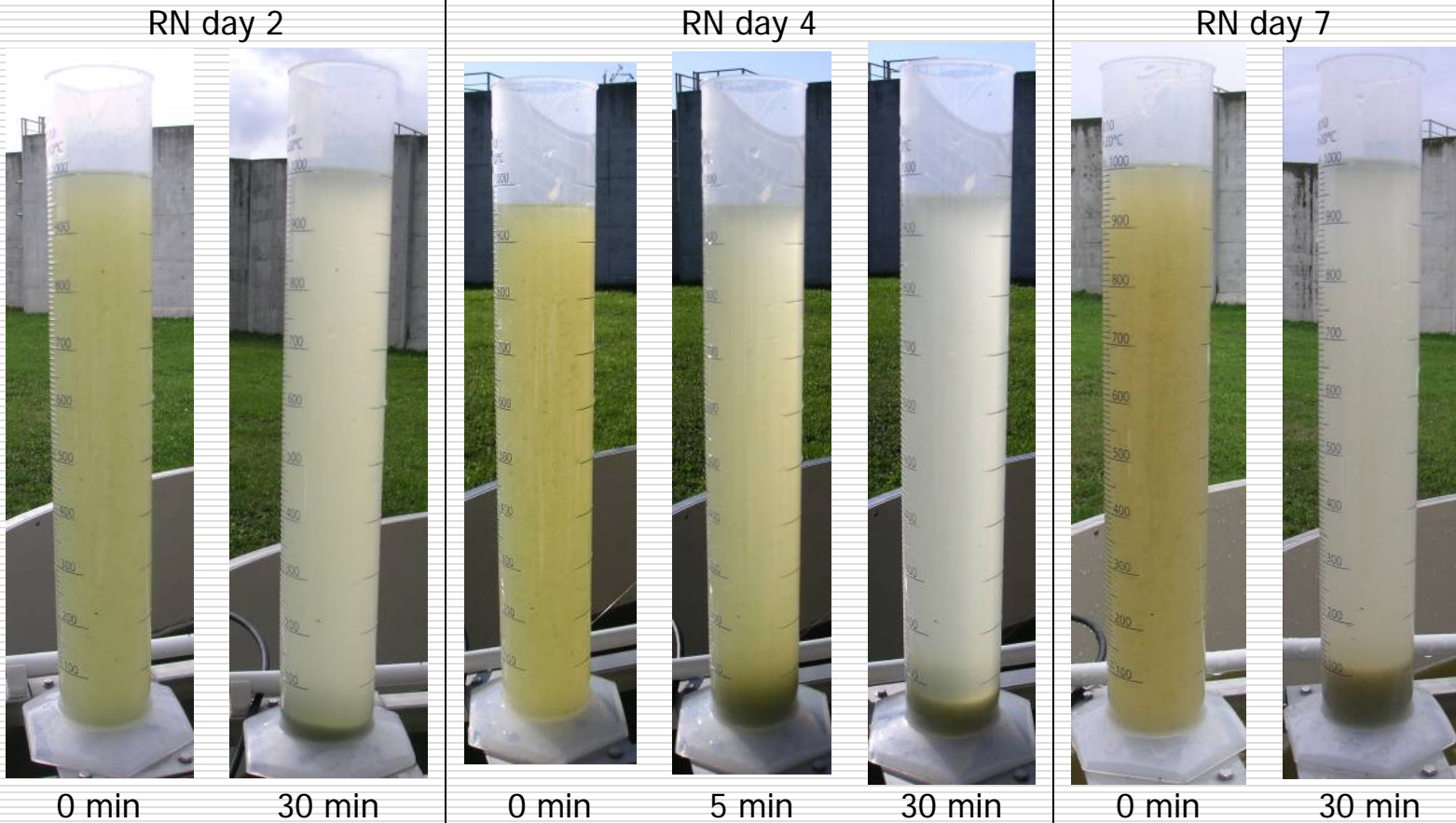
# Photo-bioreactor operation

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# Photo-bioreactor operation



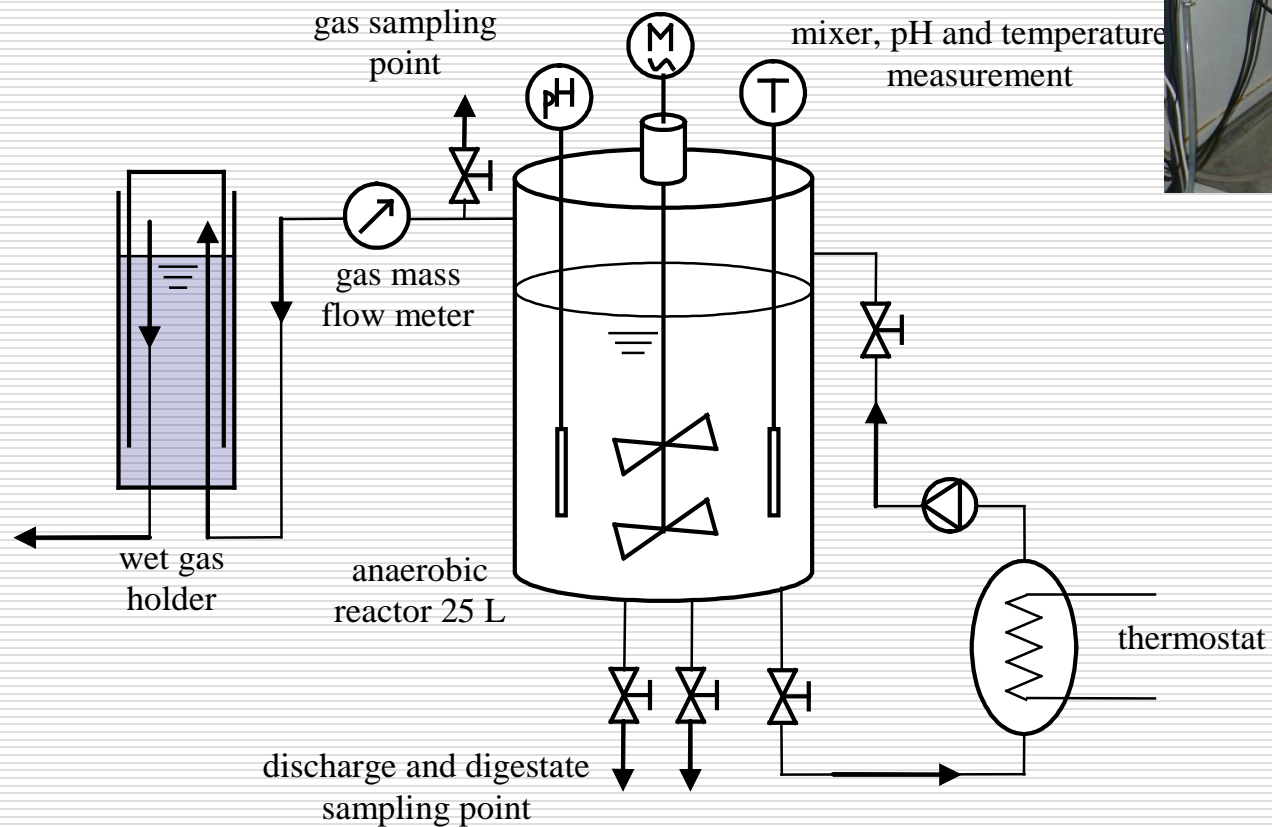
# Introduction

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- Treatment of wastewater with microalgae results in production of large amounts of biomass that needs to be disposed.
- One of the suitable technologies for microalgal biomass disposal is anaerobic digestion producing valuable biogas and solid residue that can be used as a fertilizer.
- This paper presents the results of anaerobic digestion of biomass composed of microalgae and bacteria (MaB) used for treatment of municipal and industrial wastewater.



# Materials and methods

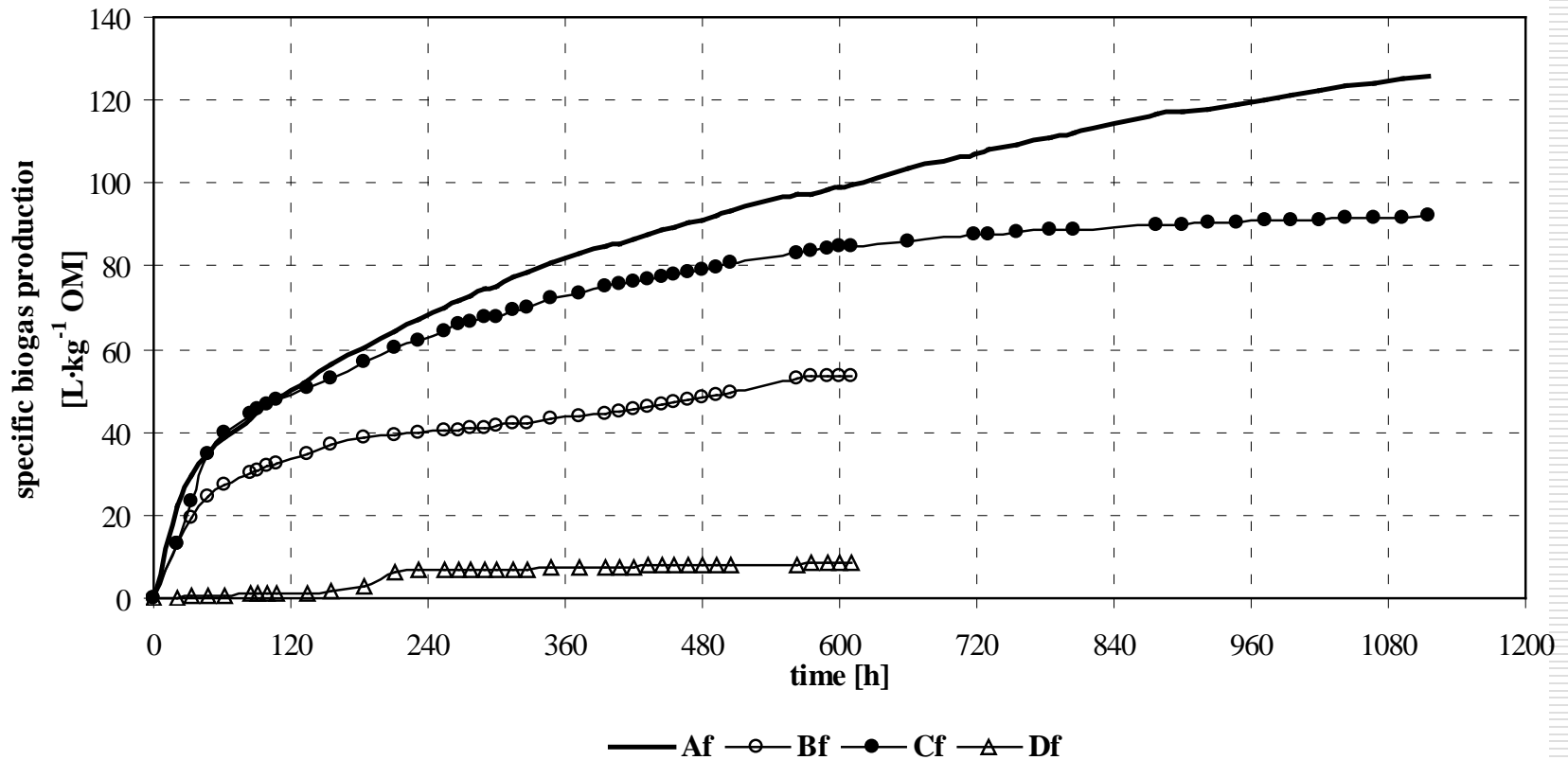


# Materials and methods

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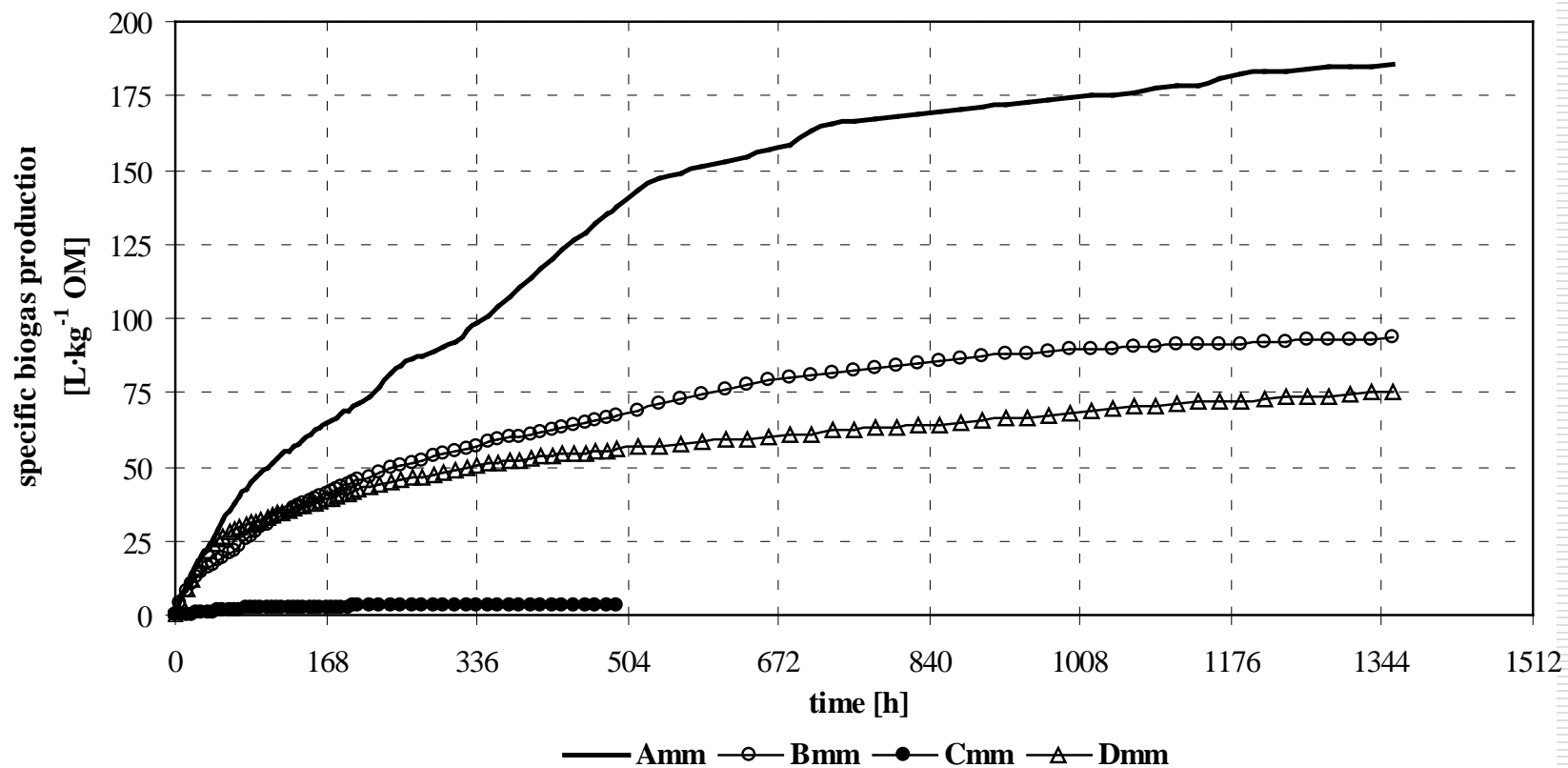
- Microalgae and bacteria biomass used as a substrate for anaerobic digestion previously served for pilot treatment of municipal and food industry wastewaters in pilot scale.
- For the experiment, four types of biomass with different composition (MaB 1 to MaB 4) were used.
- MaB 1 is biomass composed mainly of living microalgal cells.
- MaB 2 is composed mainly of bacteria and dead microalgal cells.
- MaB 3 and MaB 4 compose mainly of living microalgal cells, MaB 3 originates from treatment of food industry wastewater and MaB 4 originates from treatment of municipal wastewater.

# Results and discussion



Specific biogas production for biomass from food industry wastewater treatment

# Results and discussion



Specific biogas production for biomass from municipal wastewater treatment

# Conclusions

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- The results of anaerobic mesophilic digestion of microalgae-bacteria biomass shows that substrate composition plays an important role in biogas production.
- Digesters with added primary sludge reached the stationary phase faster than the digesters without primary sludge but the biogas production after 588 h of digestion was not significantly higher with the primary sludge.
- Thus, it may be more convenient to digest biomass without primary sludge because specific yield with added primary sludge is the same or lower than without added primary sludge.

# Conclusions

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- Results from digesters shows that the most important parameter is the ratio of inoculum to microalgae-bacteria biomass.
- Results of two series of testing are similar with respect to suitable ratio of inoculum to microalgae-bacteria biomass: biogas production increases with increasing ratio of inoculum to microalgae-bacteria biomass.
- The highest biogas yield achieved (C, 330 L·kg<sup>-1</sup> OM) is above the average of other studies.
- This is given by the nature of the biomass (biomass composed mainly of dead cell of bacteria and microalgae).



# Conclusions

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- ❑ Biogas productions in reactors with high ratio of inoculum to microalgae-bacteria biomass were similar to other studies.
- ❑ Biomass produced during treatment of municipal wastewater generally produces more biogas compared to the biomass produced during treatment of food industry wastewater.
- ❑ Composition of produced biogas was comparable to the other studies ranging from 61.5 % to 75.6 % CH<sub>4</sub>.
- ❑ Biomass produced during treatment of municipal wastewater generally produced biogas with lower methane content.

# Thank you for your attention

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