



# **PHYTOREMEDIATION OF COPPER FROM WASTEWATER BY TWO WETLAND PLANT SPECIES**

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# **Traditional Heavy Metal Wastewater Treatment Methods**

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- **Precipitation or Flocculation**
- **Ion Exchange**
- **Reverse Osmosis**
- **Microfiltration**



# Phytoremediation

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- ❁ **A Technological Process Using Vegetation For Removal And Recovery Of Contaminated Soil, Sludge, Ponds, Streams And Other Polluted Areas**

# Phytoremediation Of Uranium At Ukraine





## Five Year Cost Comparison Of Phytoremediation By Hybrid Poplar Trees Vs. Reverse Osmosis System

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1. Phytoremediation	
Design and Implementation	\$ 50,000
Monitoring Equipment	\$ 25,000
5-year Monitoring	\$ 175,000
<b>Total:</b>	<b>\$ 250,000</b>
2. Reverse Osmosis System	
Equipment	\$ 100,000
Consulting	\$ 25,000
Installation/Construction	\$ 100,000
5-year Costs	\$ 435,000
<b>Total:</b>	<b>\$ 660,000</b>



# Advantages Of Phytoremediation

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- **Relatively Low Cost**
- **Applicable to a Broad Range of Contaminants**
- **Environmentally Friendly**
- **High Public Acceptability and Aesthetically Pleasing**

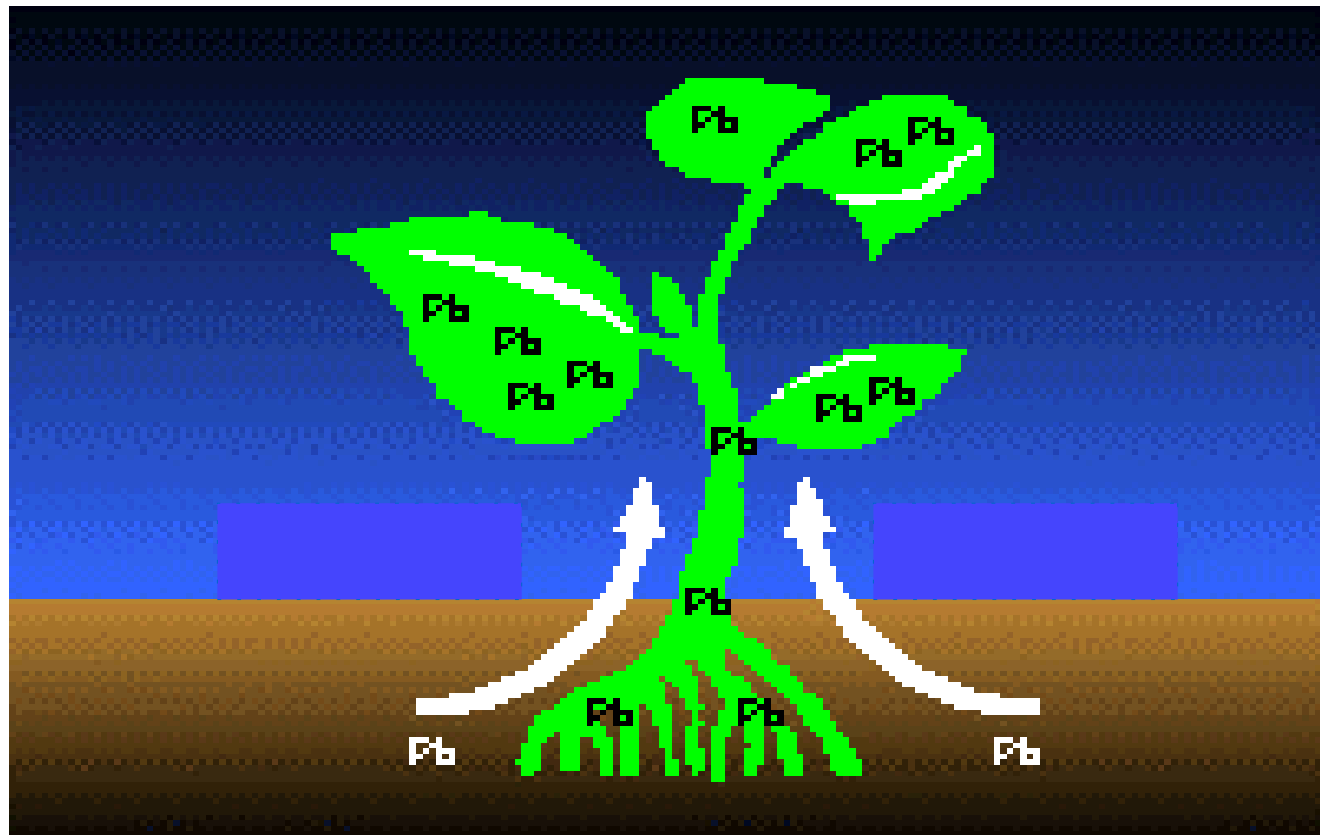


# Phytoremediation Categories

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- **Phytoextraction**
- **Phytodegradation**
- **Phytovolatilization**
- **Rhizofiltration**

# Rhizofiltration





# Duckweed



# Water Velvet





# Procedure

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- **Prepare Simulated Wastewater With Copper Nitrate and Nutrient. Copper Concentrations Were 1 mg/l - 50 mg/l**
- **Grow Plants in the Simulated Wastewater**
- **Measure Cu Concentration in the Solution By Atomic Absorption Spectrometer Every 24 Hours**



## **Procedure (Cont.)**

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- ❁ **Collect Plants From the Solution After 6 Days, Oven Dry Plants, Followed by Microwave Digest**
- ❁ **Measure Cu Concentration in the Digest Solutions And Calculate Cu Concentration in the Plant Tissue and Bioconcentration Factors (BCF)**

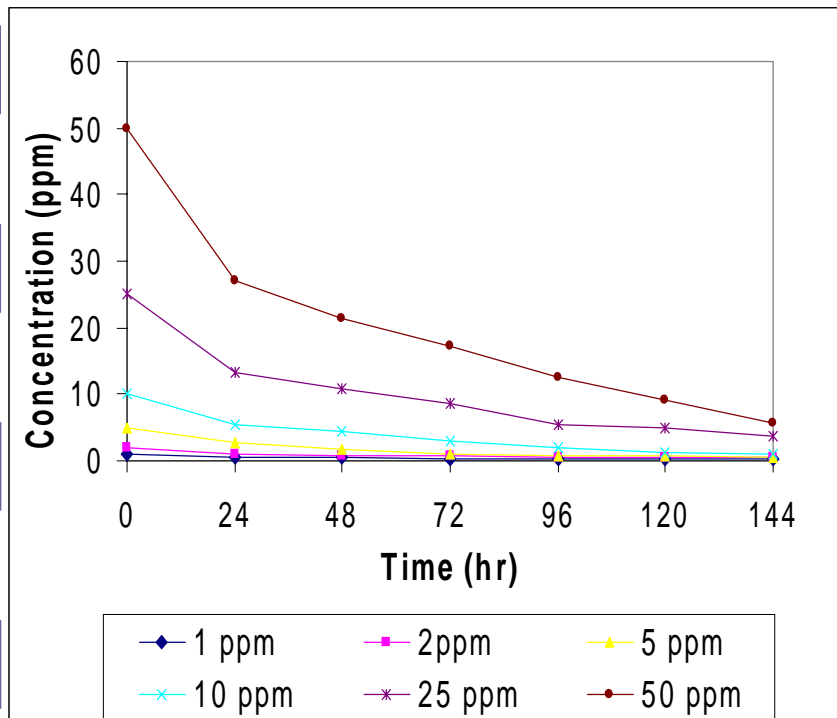


# Calculation

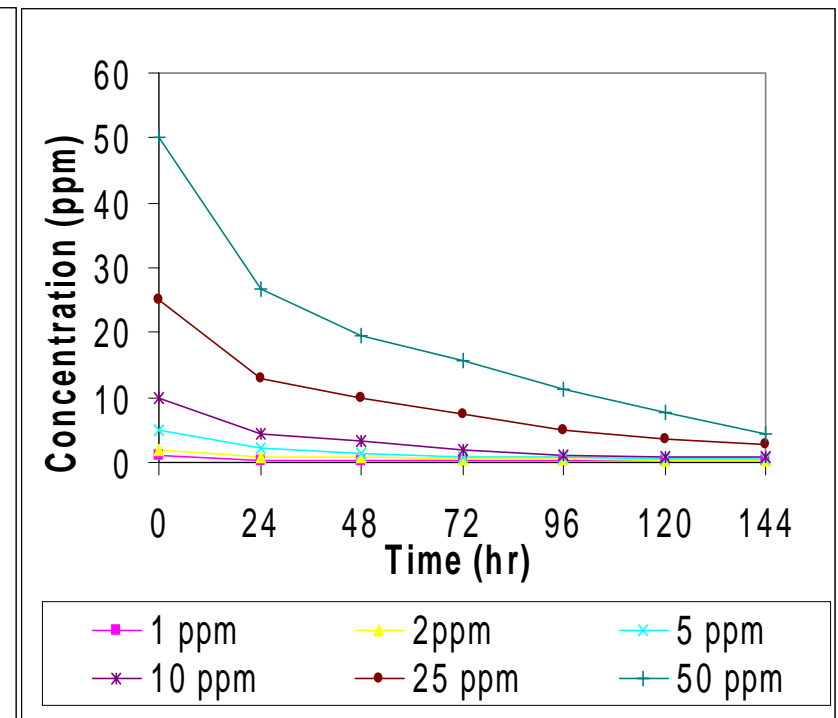
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- **Cu Concentration In Plant Tissue (g/Kg) = Cu Concentration in the Digest Solution (g/l) X Volume of the Digest Solution (l) ÷ Weight of the Plant (kg)**
- **Bioconcentration Factor (BCF) = Cu Concentration in Plant Tissue (mg/kg) ÷ Initial Copper Concentration in the External Solution (mg/l)**

# Copper Concentration Remaining In The Solution

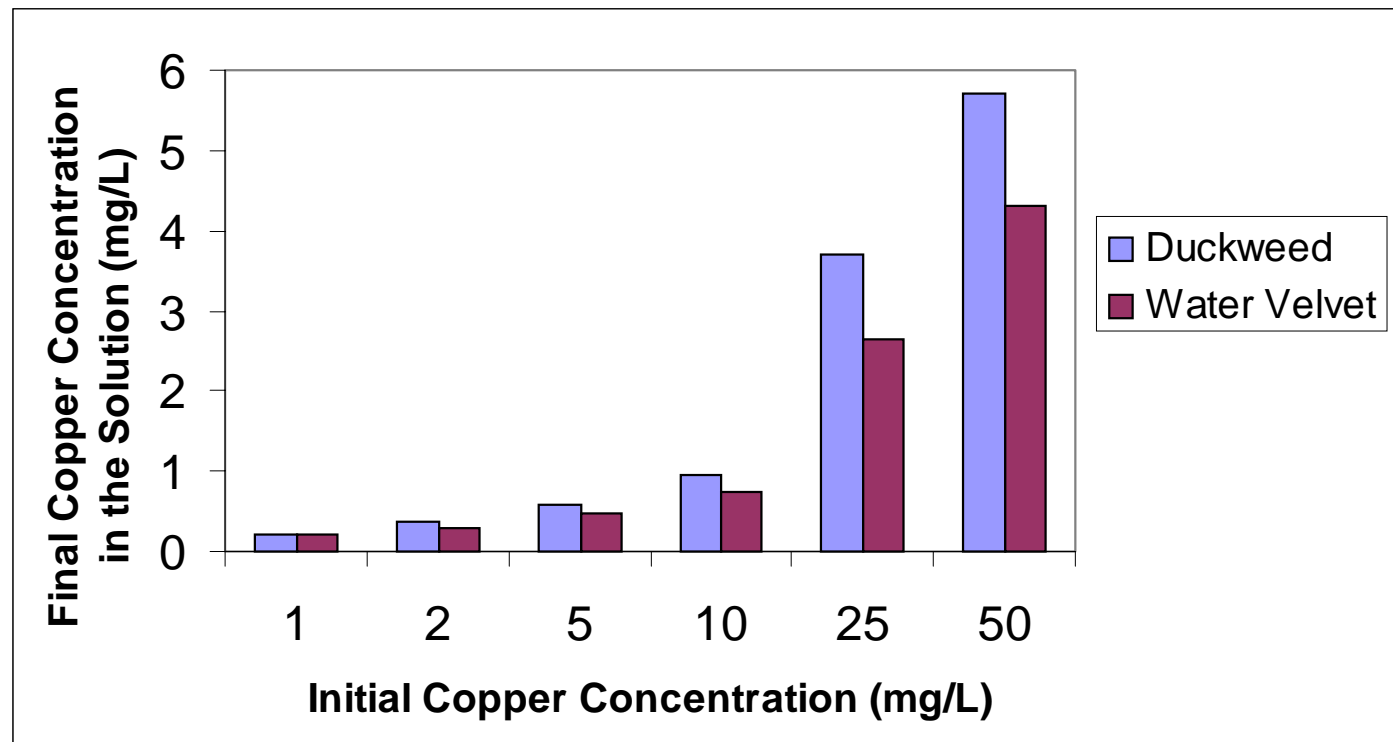


Duckweed

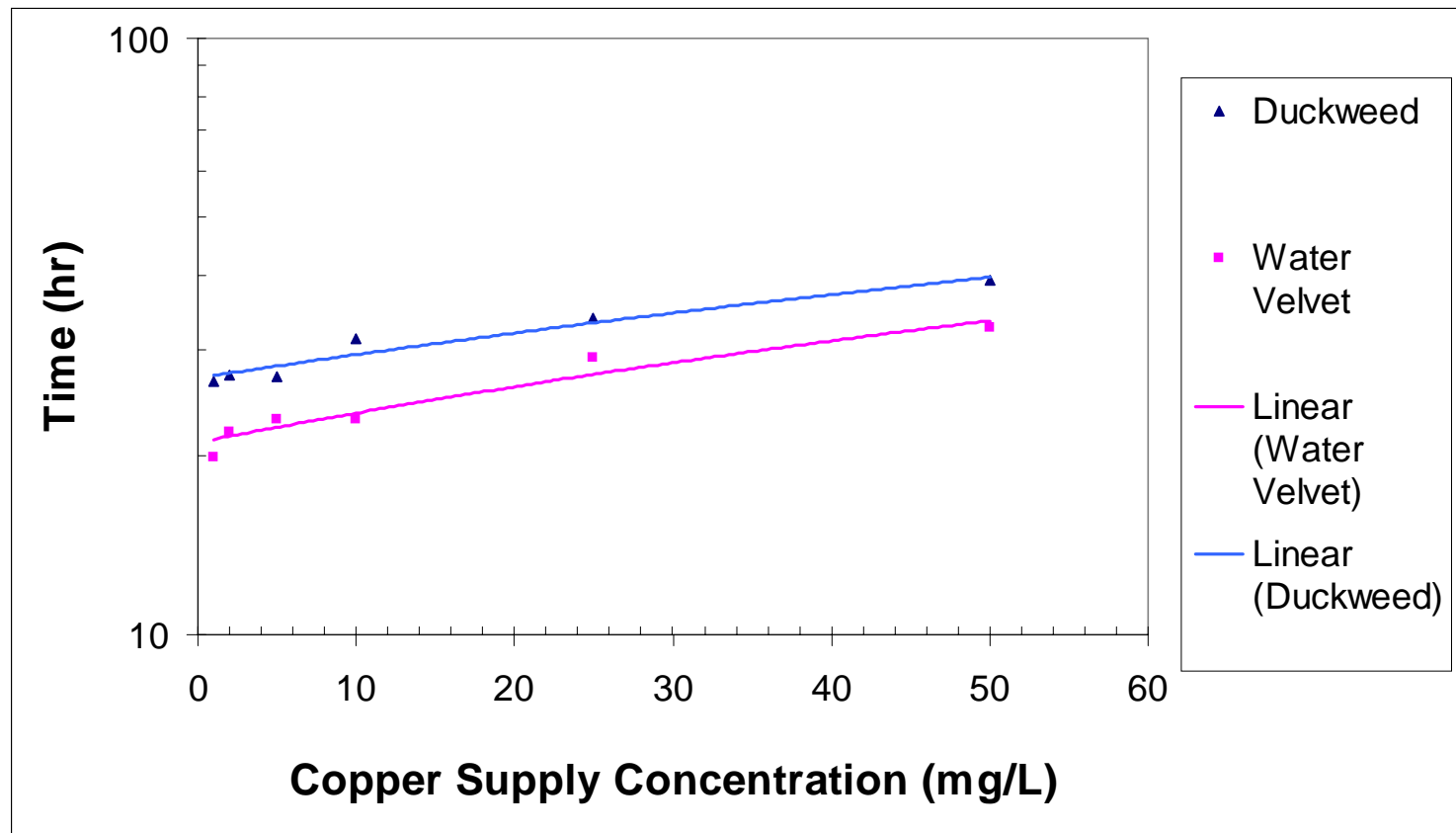


Water Velvet

# Final Copper Concentration In The Solution At Different Initial Copper Concentrations

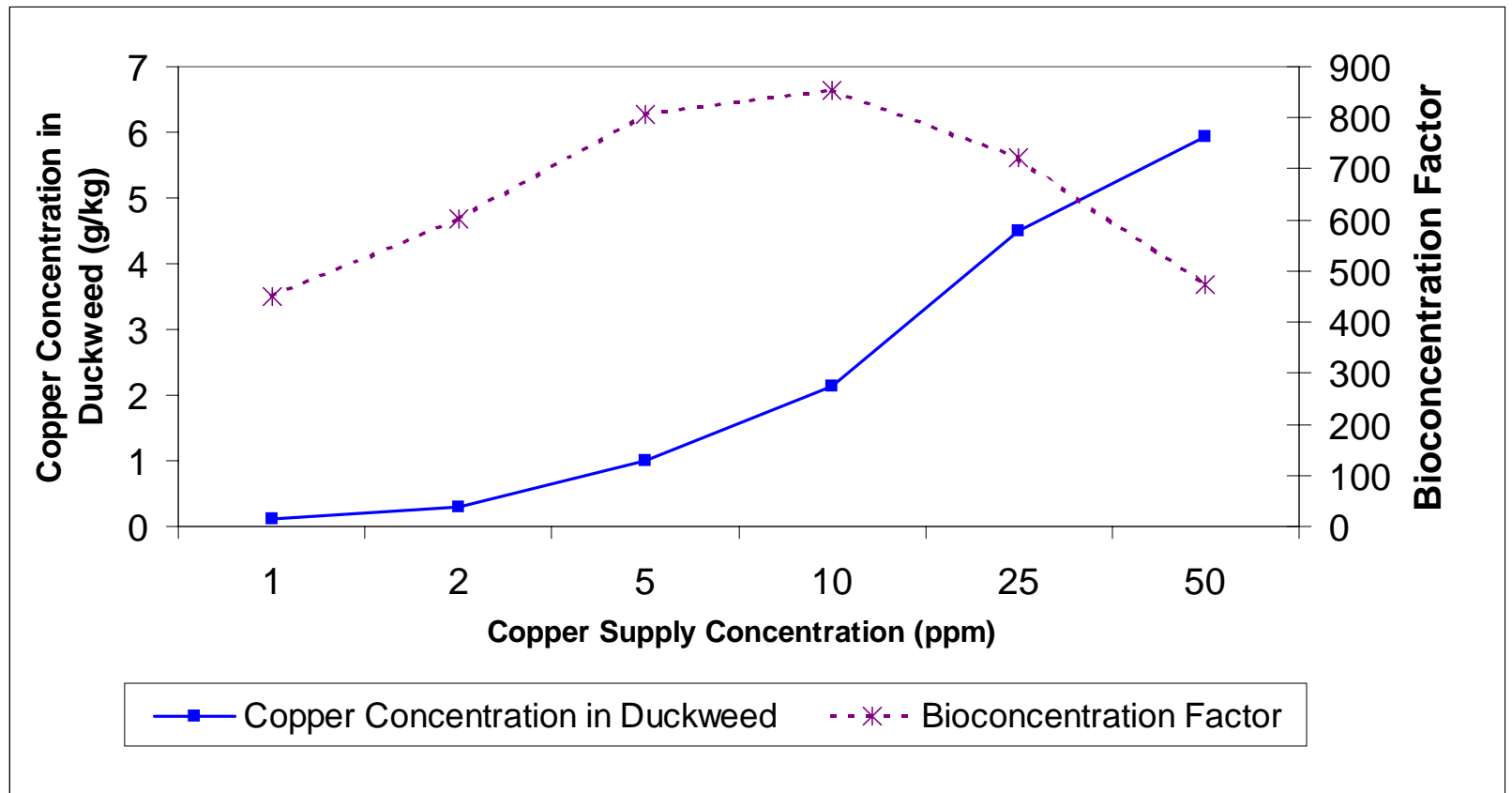


# Relationship Between Initial Copper Concentration And The Time Required To Reduce Copper Concentration In The Solution By 50%

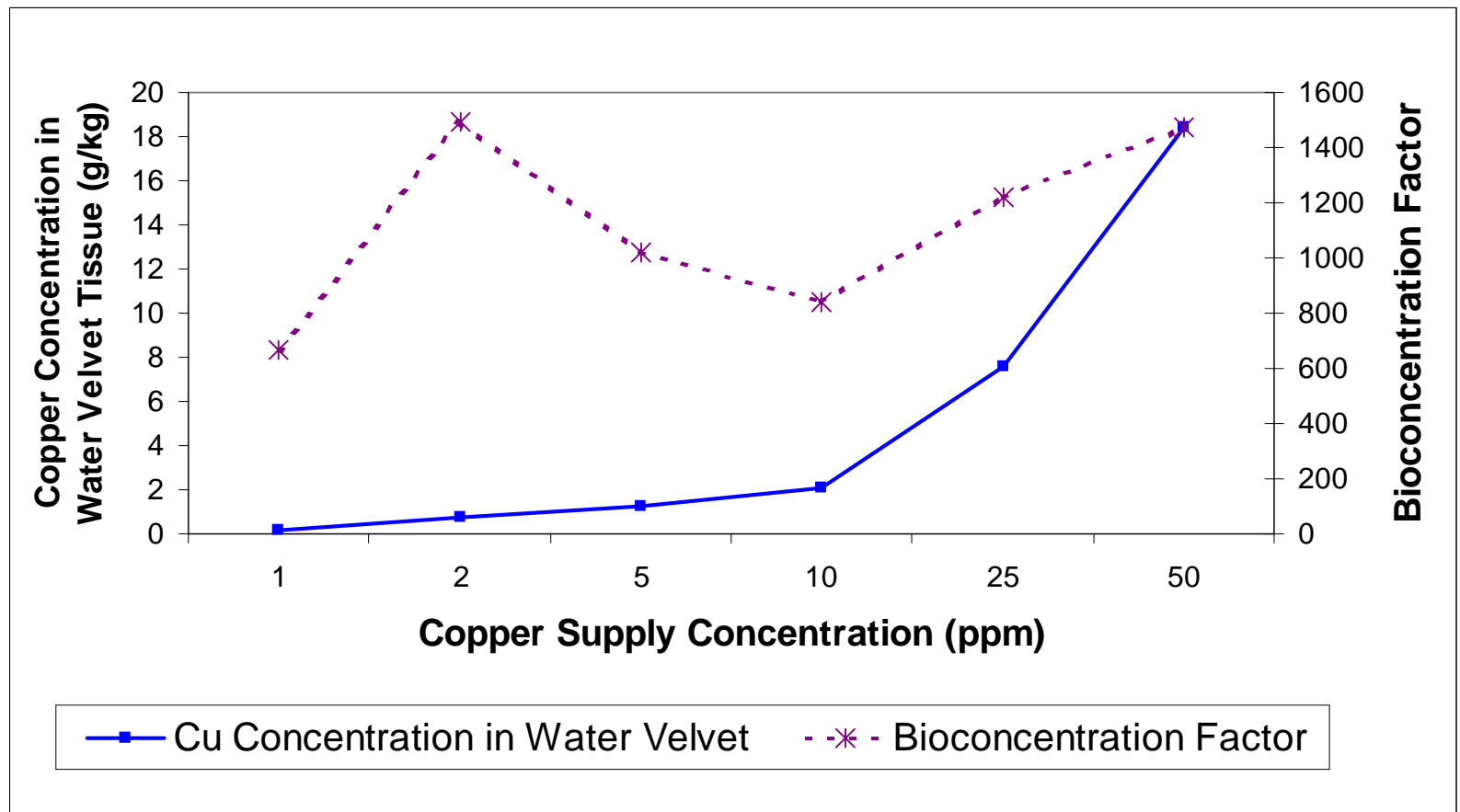




# Influence Of Initial Copper Concentration On Copper Concentration In Duckweed Tissue And Copper Bioconcentration Factor



# Influence Of Initial Copper Concentration On Copper Concentration In Water Velvet Tissue And Copper Bioconcentration Factor





# Conclusion

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- **Duckweed and Water Velvet Are Good Copper Accumulator**
- **Water Velvet Has a Faster Copper Absorption Rate Than Duckweed**
- **Copper in Semiconductor Wastewater Can Be Phytoremediated by Duckweed and Water Velvet**



# Acknowledgements

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