PESTICIDE PHOTOOXIDATION BY PHOTOZYMES

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1. PHOTOZYMES AS NANOASSEMBLES

PHOTOZYMES ARE AMPHIPHILIC COPOLYMERS, FORMING MACROMOLECULAR MICELLES WITH A CORE FROM THE HYDROPHOBIC AND CHROMOPHORIC MONOMER UNITS AND SHELL FROM THE HYDROPHILIC ONES. THEIR PREPARATION AND PHOTOCATALYTIC ACTIVITY ARE INSPIRED BY THE NATURAL PHOTOSYNTHETIC SYSTEMS AND ANTENNA EFFECT FOR A LIGHT HARVESTING (Fig. 1).

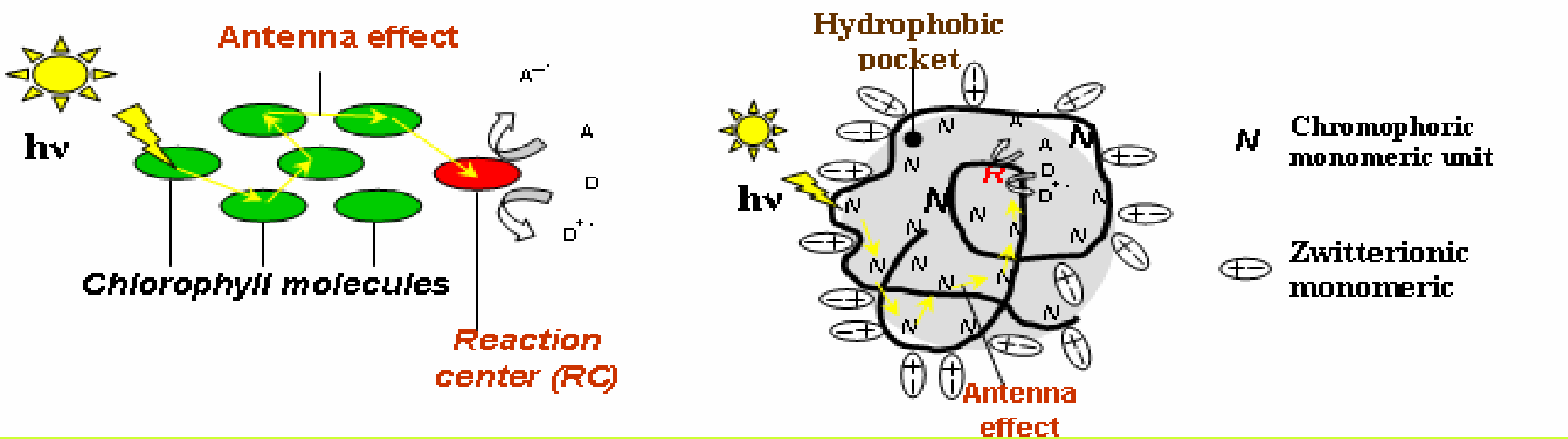


Figure 1. Comparison between the caring natural photosynthesis and porphyrin light–harvesting between thylakoid membranes (A) and the photocatalysts in the photozyme micelles, produced from the amphiphile copolymers (photozymes, B).

2. PHOTOZYME PREPARATION

2.1. Covalent binding of the Xanthenes (Ch, BR) to Chitosan

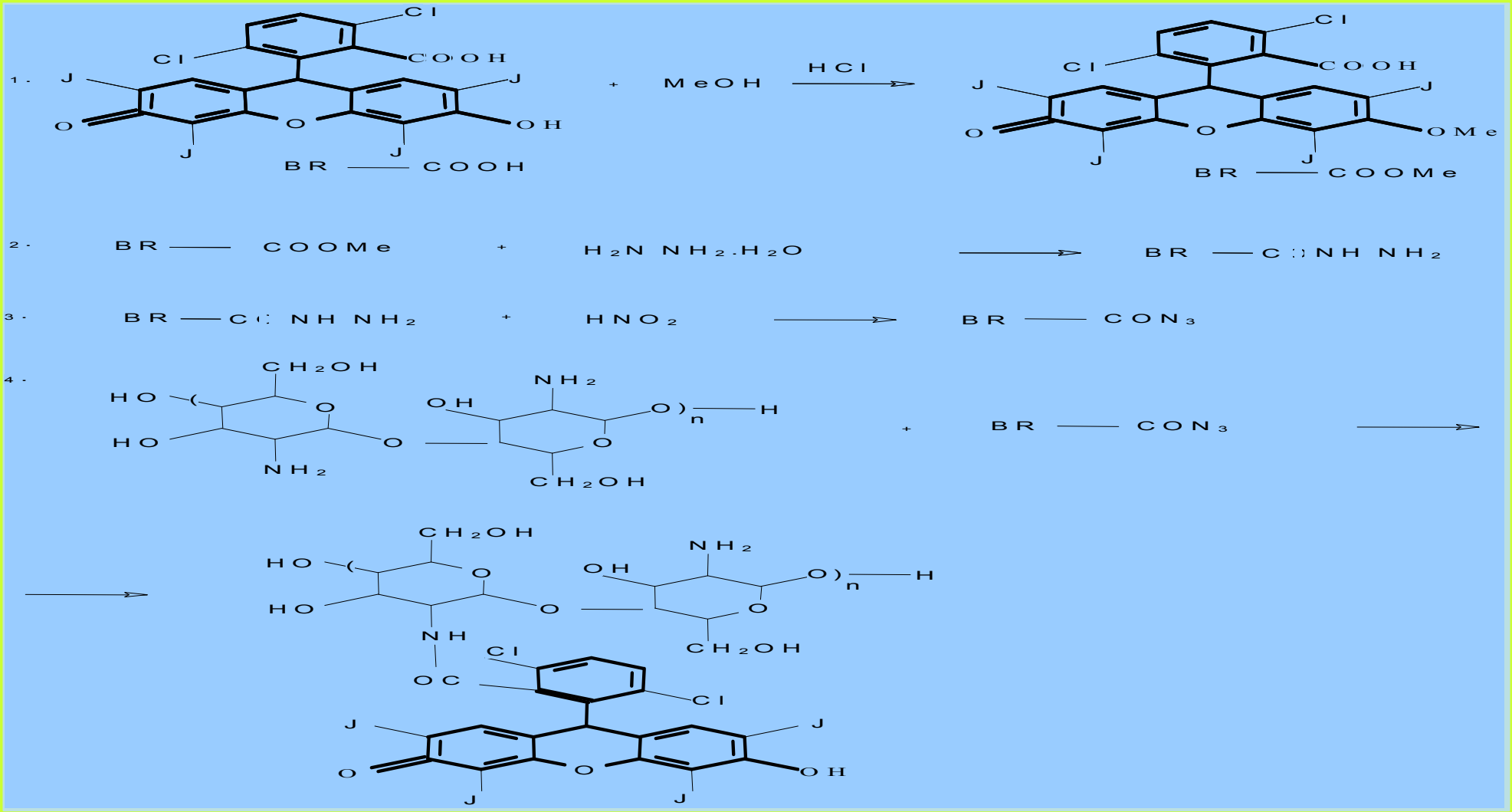
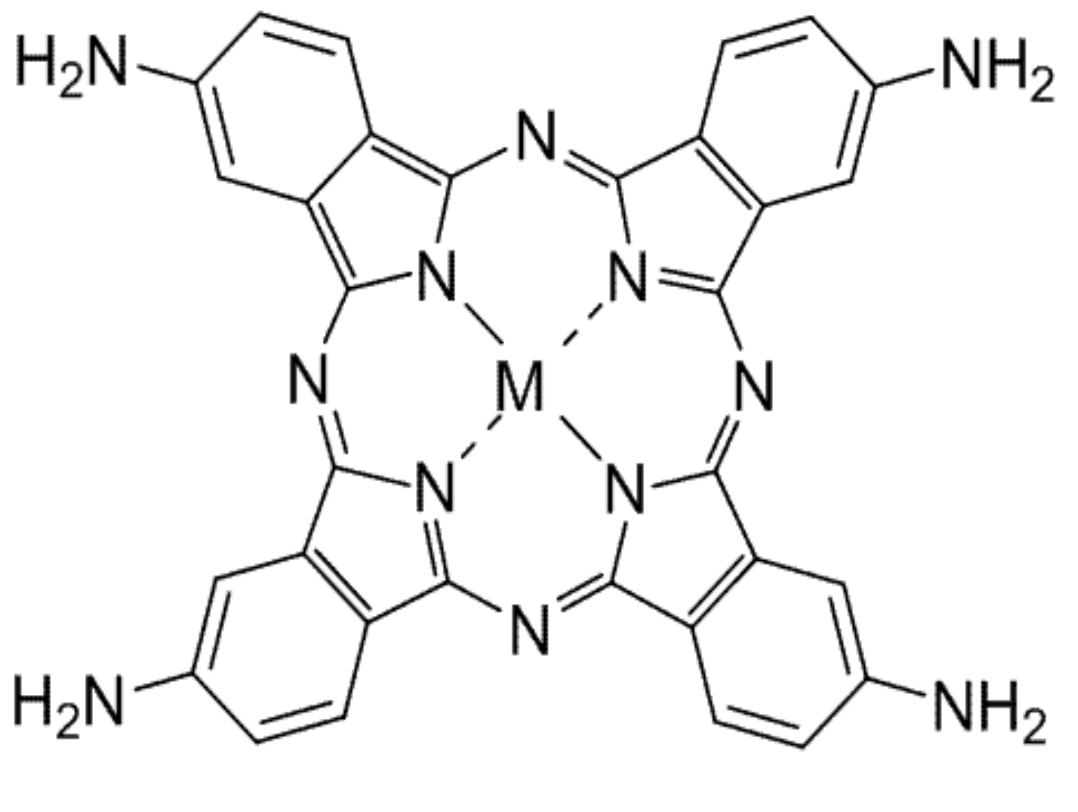


Figure 2. Four stage azide method for the covalent binding of xanthene (BR, FL) to chitosan.

3. HETEROGENEOUS PHOTOZYMES

3.1. Mixtures of Phthalocyanine pigments with Goethite and FI-containing photozyme for a photo-Fenton pesticide oxidation



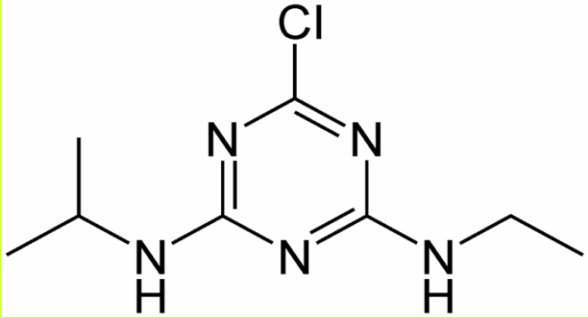
2,9,16,23–Tetraaminophtalocyanines (TAPC) pigment used for a heterogeneous pesticide photo-Fenton oxidation. M = Cu, Co, Pd, Al.

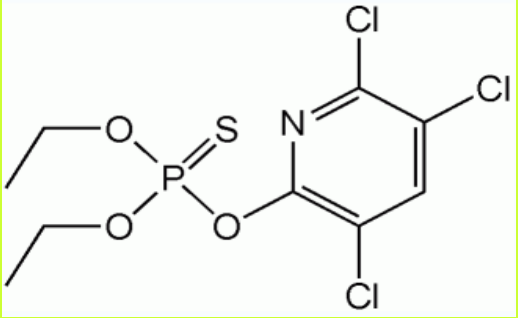
4. PHOTOZYME APPLICATION FOR A PHOTO-0DEGRADATION OF ATRAZINE, CHLORPYRIFOS, BENOMYL etc.

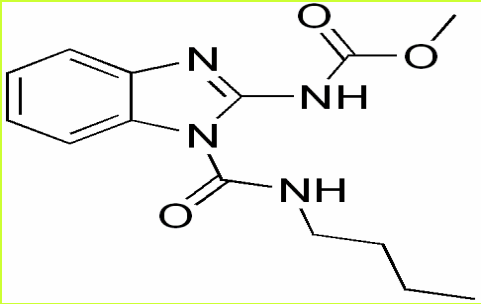
4.1. ATRAZINE (2-chloro-4-(ethylamine)-6-(isopropylamine)-s- triazine), used to stop the pre- and post-emergency broadleaf and grassy weeds in major crops

4.2. CHLORPYRIFOS (O,O-diethyl-o-3,5,6-trichloro-2-pyridilphosphorotionate), toxic organophosphate insecticide, used to control insect pests.

4.3. BENOMYL (Methyl[1-[butylamino]carbonyl]-h-benzimidazol-2-yl]carbonate), benzimidazole fungicide, selectively toxic to micro-organisms and invertebrates, especially earthworms







ATRAZINE **CHLORPYRIFOS** **BENOMYL**

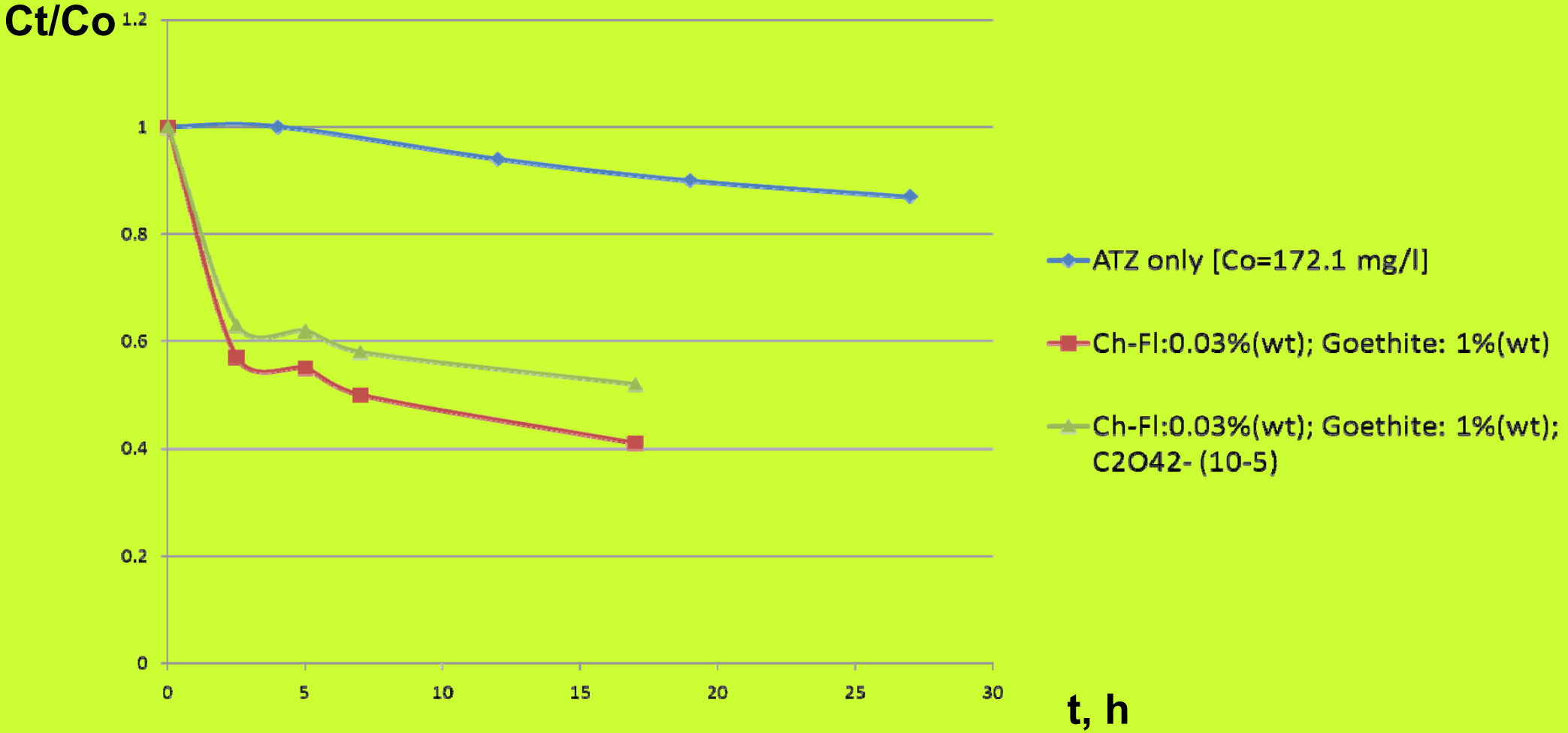


Figure 3. Relative decrease of the **Atrazine (ATZ)** concentration (**Ct/Co**) as a function of the irradiation time (**t**) with a visible light in the presence of the mixture of **Goethite and Ch/Fl**.

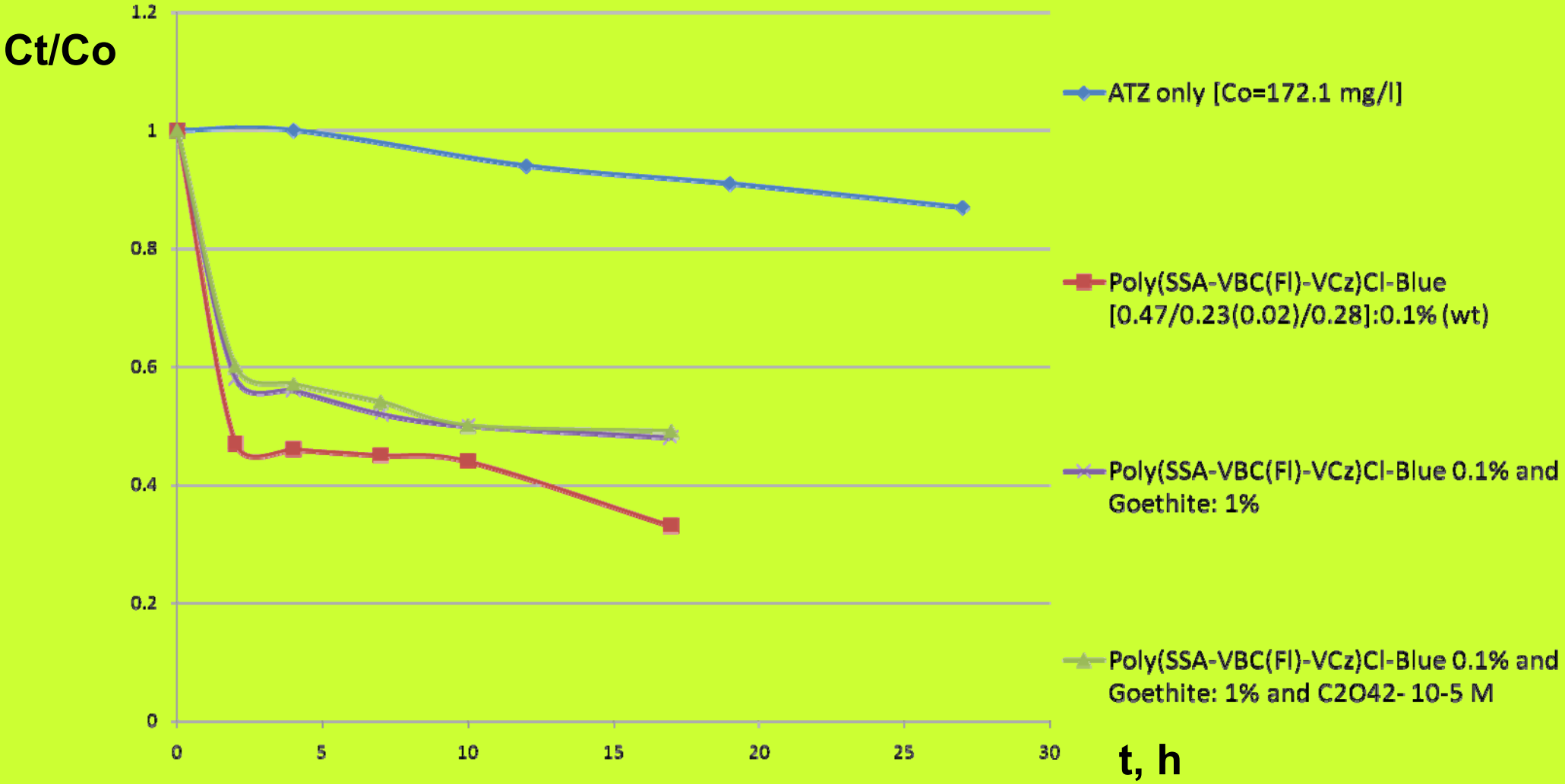


Figure 4. Relative decrease of the **Atrazine (ATZ)** concentration (**Ct/Co**) as a function of the irradiation time (t) with a visible light in the presence of the mixture of **Goethite, FI-Photozyme and Pigment.**

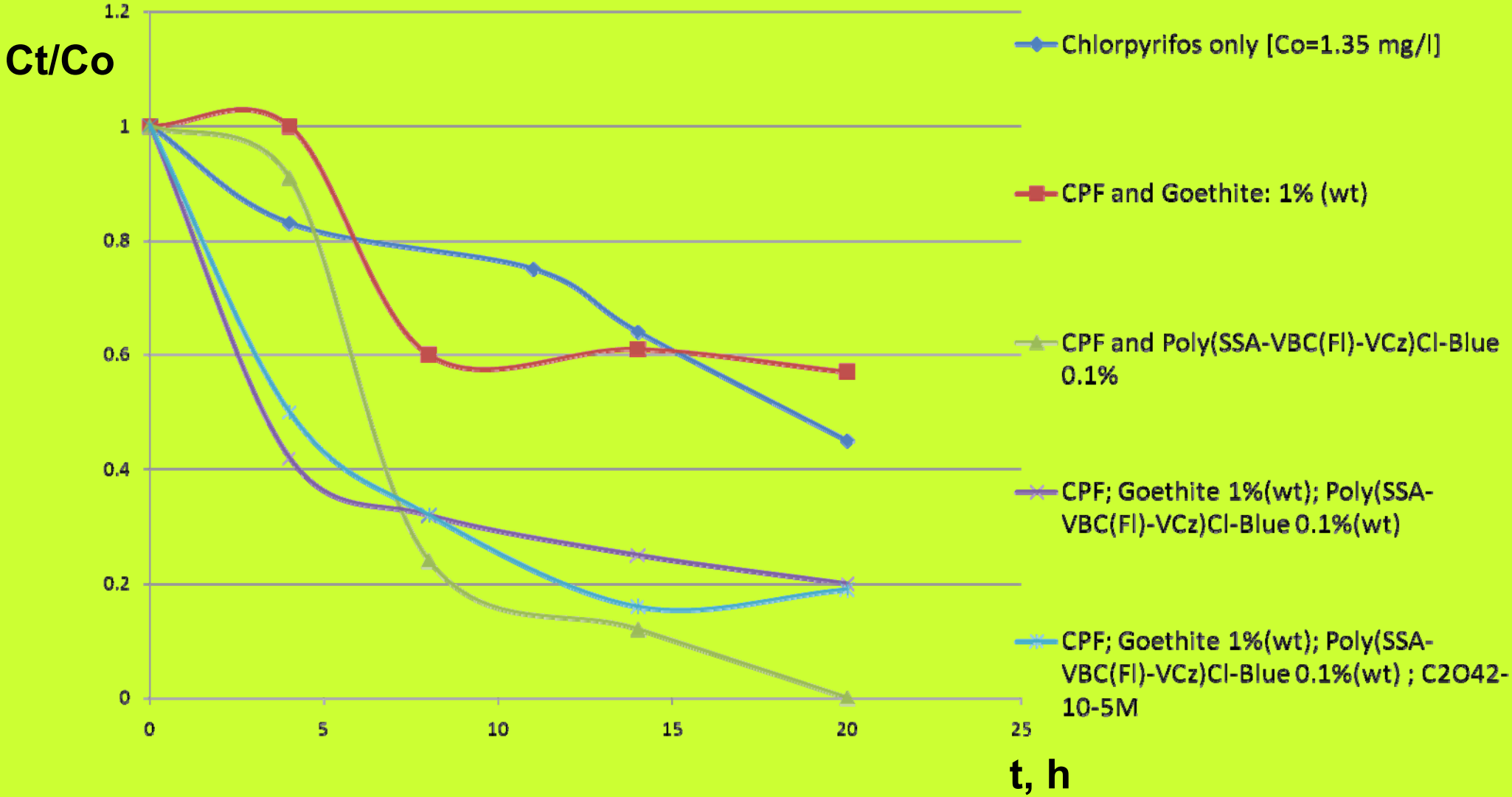


Figure 5. Relative decrease of the **Chlorpyryfos (CPF)** concentration **(Ct/Co)** as a function of the irradiation time **(t)** with a visible light in the presence of the mixture of **Goethite, Fl-Photozyme and Pigment**.

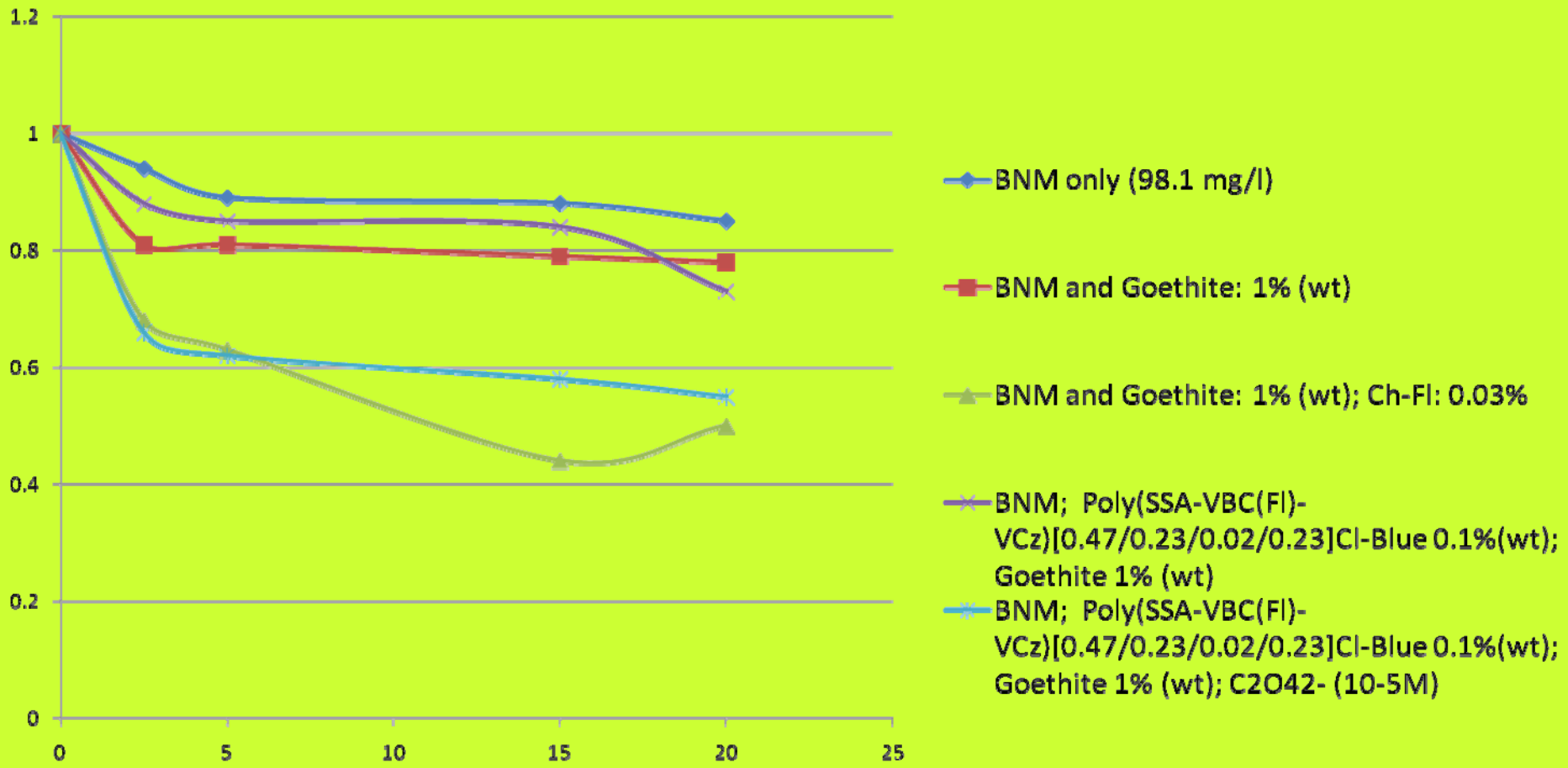


Figure 6. Relative decrease of the **Benomyl (BNM)** concentration (**Ct/Co**) as a function of the irradiation time **(t)** with a visible light in the presence of the mixture of **Goethite, Fl-Photozyme and Pigment.**

CONCLUSIONS

1. EFFECTIVE ATZ, CPF and BNM PHOTOOXIDATION BY HETEROGENEOUS FI-CONTANING PHOTOZYMES IS ESTABLISHED.
2. 20 h IRRADIATION TIME WITH SOLAR ENERGY OF CPF IS ENOUGH FOR ITS FULL DEGRADATION.
3. THESE ORIGINAL RESULTS DEMONSTRATE:

- THROUGH THE PHOTOZYMES THERE IS A POSSIBILITY TO USE THE SOLAR ENERGFY FOR AN EFFECTIVE WATER PURIFICATION FROM PESTICIDES.
- FORSTER RESONANCE ENERGY TRANSFER (FRET) MECHANISM FOR AN EXCITED ENERGY TRANSFER FROM PHOTOZYME CHROMOPHORE TO PESTICIDE MOILECULE IS PROPOSED.

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THANK YOU!