"Development of doped-$KMgF_3$ fluoro-perovskite nanoparticles with upconversion properties for potential biomedical application"

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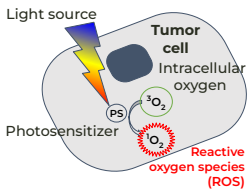
INTRODUCTION

Photodynamic therapy (PDT)

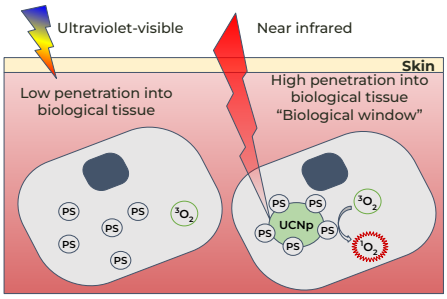
Advantages

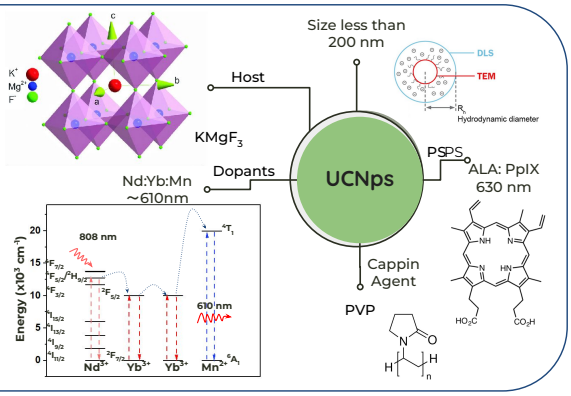
It has a lower degree of side effects than conventional antitumor therapies such as chemotherapy and radiotherapy.



Limitations

Clinically approved PS are activated by UV-Vis light "Biological window" (NIR, 700-2500 nm).





OBJECTIVE

Development of nanoparticles of fluoro-perovskites doped with transition metal and rare earth, with upconversion properties and potential application in photodynamic therapy for tumor treatment.

METHODOLOGY

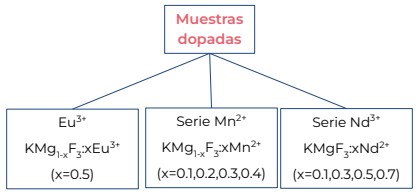
Solvothermal synthesis

Solvents: H_2O, EtOH, Oleic acid

Reactivos: $MgCl_2 \cdot 6H_2O$, NH_4F, KOH

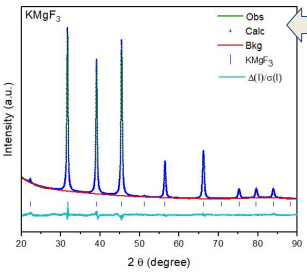
Experimental design 2^4 for $KMgF_3$ synthesis

Predictor variables	Response variable
Temperature Time $[MgCl_2]$ $[NH_4F]$	Estimated particle size

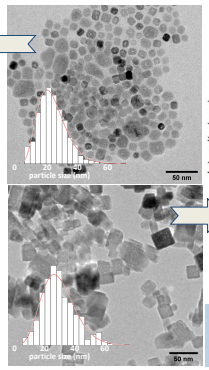


RESULTS

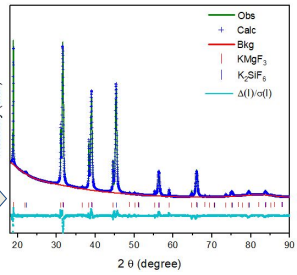
XRD



HR-TEM



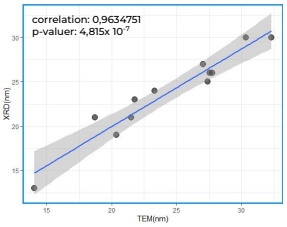
$KMgF_3$ cubic phase and another phase were assigned when $[NH_4F]$:$[MgCl_2]$ ratio is 2:1



Most of the data fit a gamma distribution

Size correlation

Pearson's correlation coefficient



XRD
13,46 ±0,30 nm to 32,18 ±0,60 nm
TEM
14,22 ±4,47 nm to 32,38 ±9,99 nm

Statistical analysis

Linear regression model

t-student test

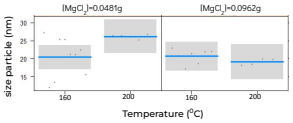
$Y_i = \beta_0 + \beta_1 X_i + \varepsilon$

H_0: $\beta_1 = 0$
H_1: $\beta_1 \neq 0$

significance 0.05

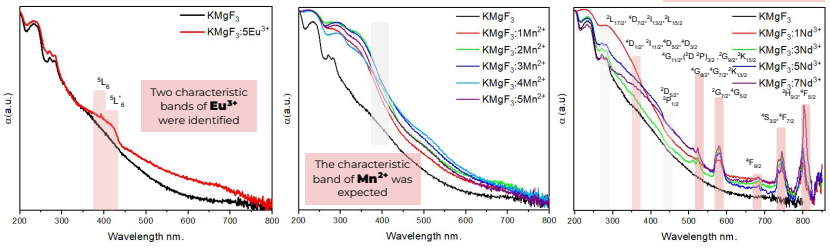
Coefficients

	Estimated	Std. Error	t value	Pr(>|t|)
(Intercept)	23.4954	2.0114	11.681	7.78e-10
Temperature	5.7585	2.2191	2.595	0.0183
Time	-3.0797	2.2312	-1.380	0.1844
NH_4F	-0.3383	2.4922	-0.136	0.8935
$MgCl_2$	0.2814	2.0047	0.140	0.8899
Time:NH_4F	5.7622	3.2003	1.800	0.0886
Temperature:$MgCl_2$	-7.3669	3.3078	-2.227	0.0389



Temperature and the Temperature:$MgCl_2$ interaction present a significant effect

Absorption

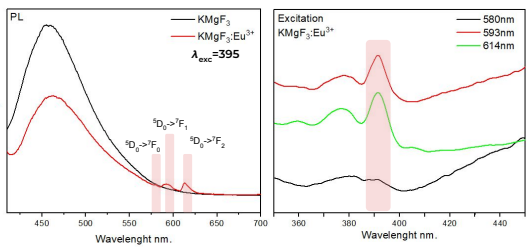


Two characteristic bands of **Eu^{3+}** were identified

The characteristic band of **Mn^{2+}** was expected

Several characteristic bands of **Nd^{3+}** were identified

Luminescence



The emission bands at 580 593 and 614 nm were observed, which are characteristics of the **Eu^{3+}** when it is excited with 395 nm

The three emission bands observed present the maximum excitation band at 395nm

CONCLUSIONS

- ✔ $KMgF_3$ was obtained with the selected synthesis.
- ✔ The nanoparticle sizes obtained for all the samples are adequate to continue with the work.
- ✔ Characteristic absorption bands of Eu^{3+} and Nd^{3+} were observed.
- ✔ Characteristic emission bands of Eu^{3+} were observed when excited with 395nm.

FUTURE WORK

- ➔ Continue with the optical characterizations and define the appropriate concentrations of dopants.
- ➔ Functionalize the nanoparticles with the PS.
- ➔ Evaluate the cytotoxicity of functionalized nanoparticles

Acknowledgment

Alvaro Olivera for the images of HRTEM and Heinkel Bentos Pereira for the XRD measurements, both belonging to the GDMEA group, CURE. Financial support by ANII FCE_3_2020_1_162287,CAP and CSIC.