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INTRODUCTION

Human immunodeficiency virus (HIV) is a public health problem worldwide. According to the WHO, 37.7 million people were infected in 2020 with HIV, 53% being women.¹ The development of peptide microbicides combined with nanotechnological tools might allow to obtain novel strategies to prevent HIV transmission.

Our group has previously reported a 18-mer linear peptide (namely E1P47), with a broad spectrum activity against HIV-1 and encapsulated it into polymeric nanoparticles (NPs).²⁻⁴ In this work, novel PLGA-based mucoadhesive biodegradable NPs were designed to encapsulate E1P47 and enhance its penetration properties through the vaginal mucosa.

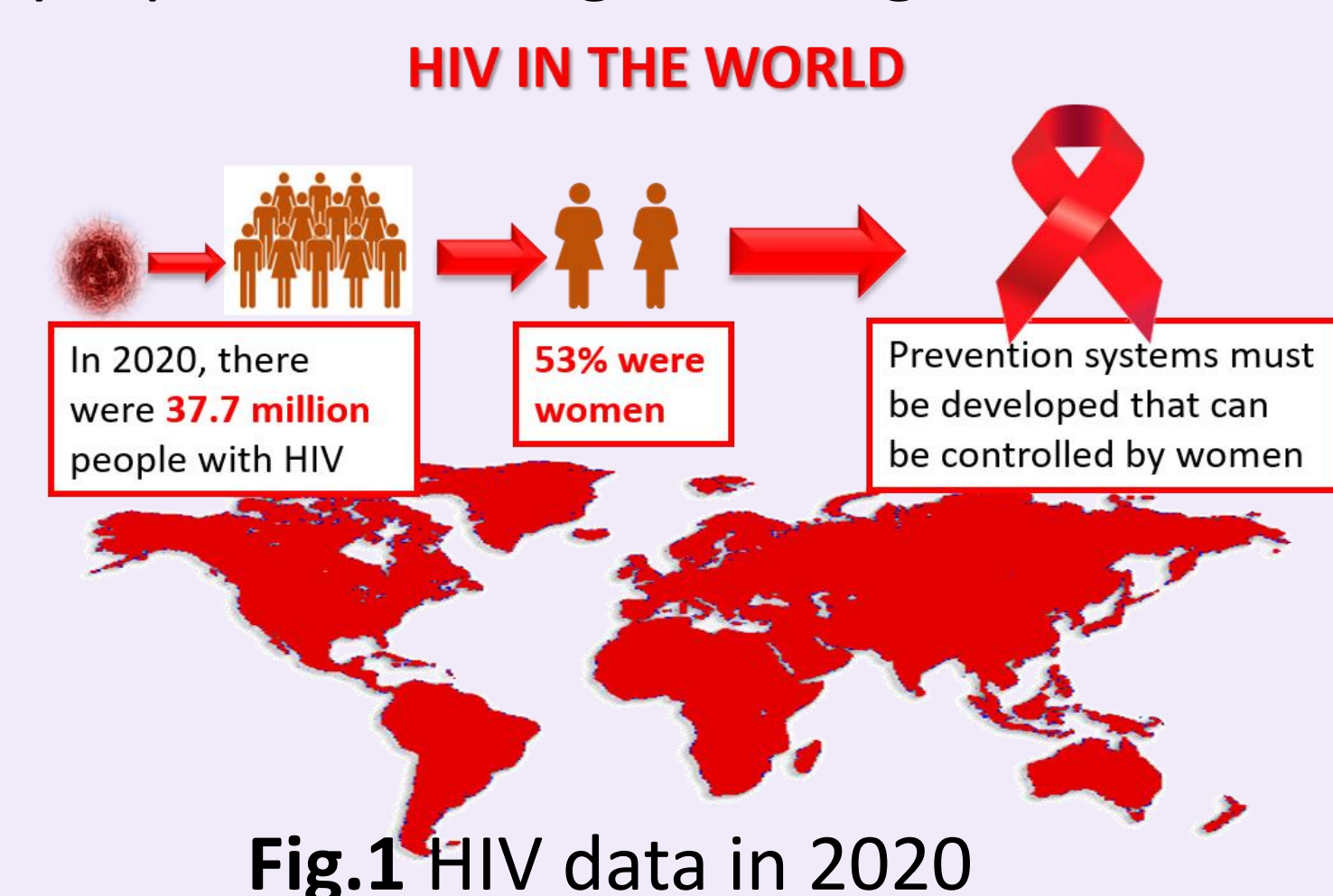


Fig.1 HIV data in 2020

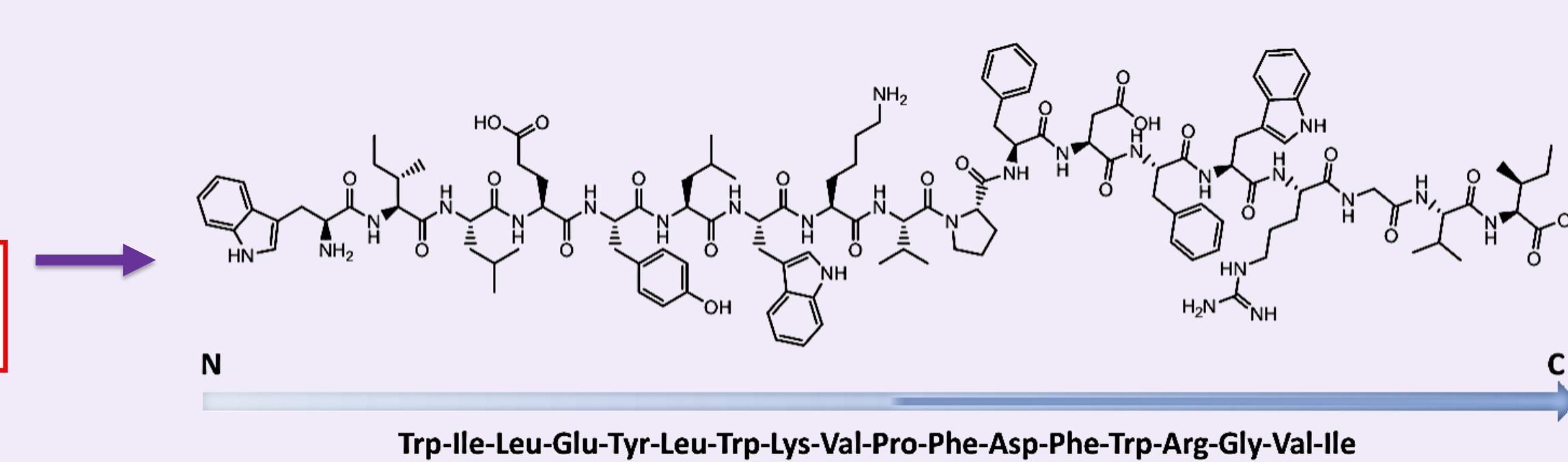


Fig.2 Anti-HIV-1 peptide

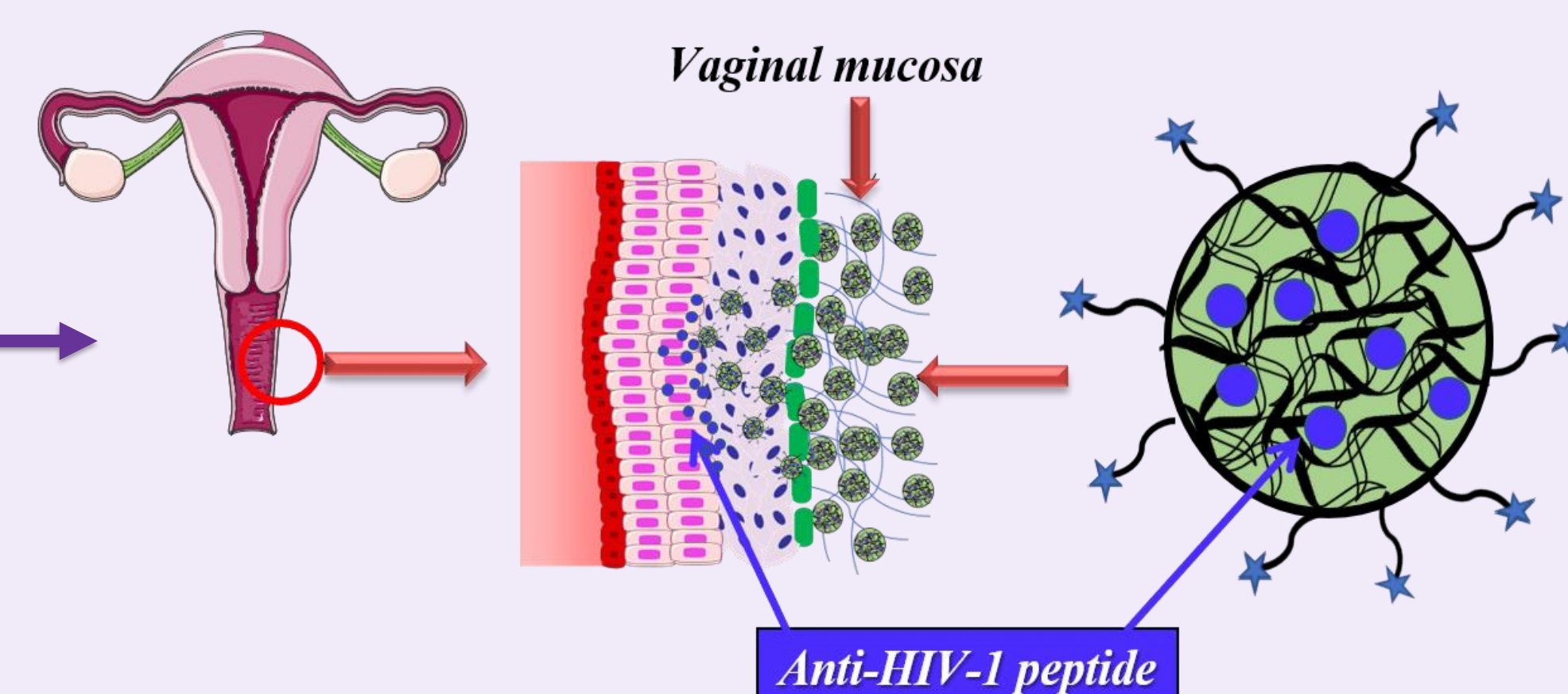


Fig.3 Vaginal administration of NPs

MATERIALS AND METHODS

E1P47 has been synthesized by Solid Phase Peptide Synthesis (SPPS).

NPs loading E1P47 were prepared by the modified double emulsion method (W/O/W).

The optimal formulation was designed through a factorial design and the NPs were characterized according to their physicochemical characteristics.

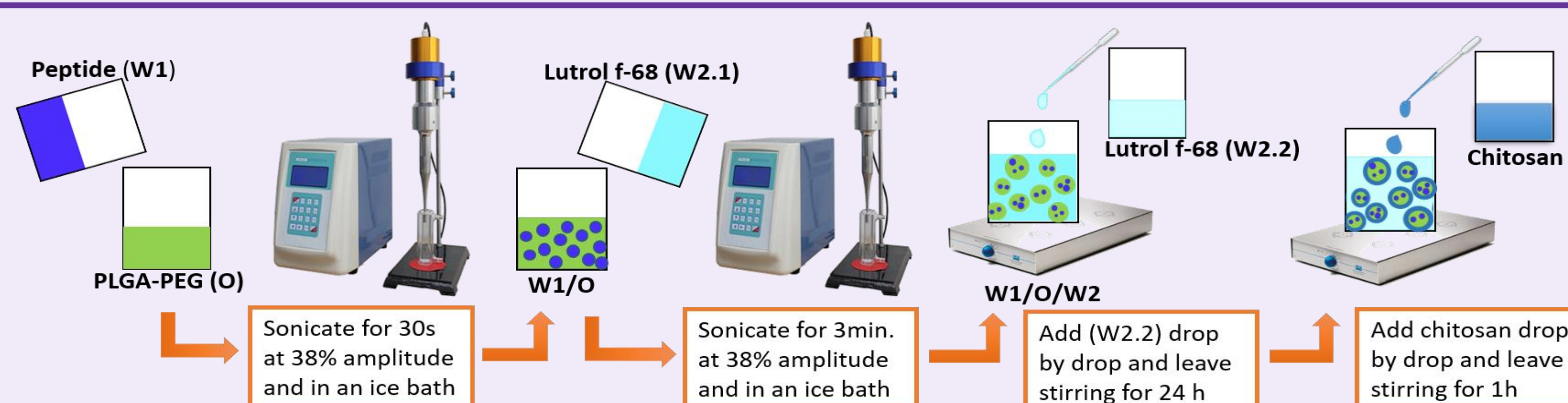


Fig.4 NPs preparation method

RESULTS AND DISCUSSION

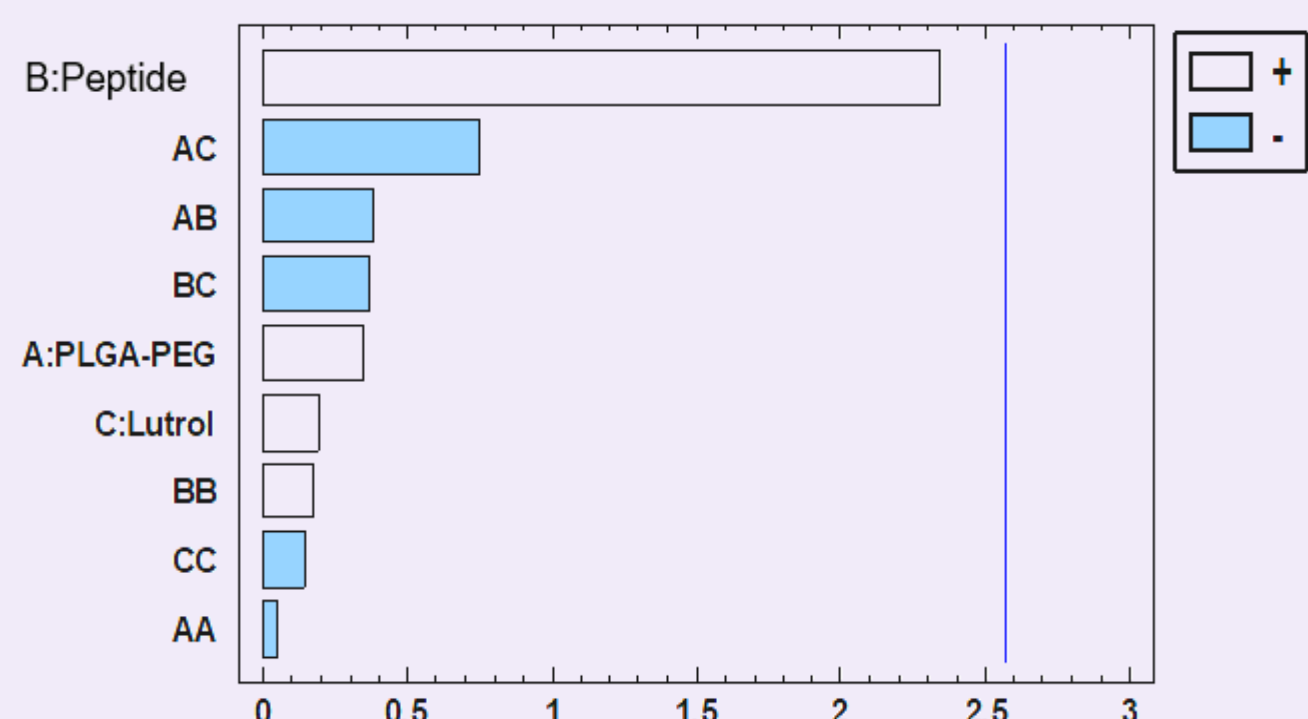


Fig.5 Pareto diagrams belonging to the factorial design for the ZP

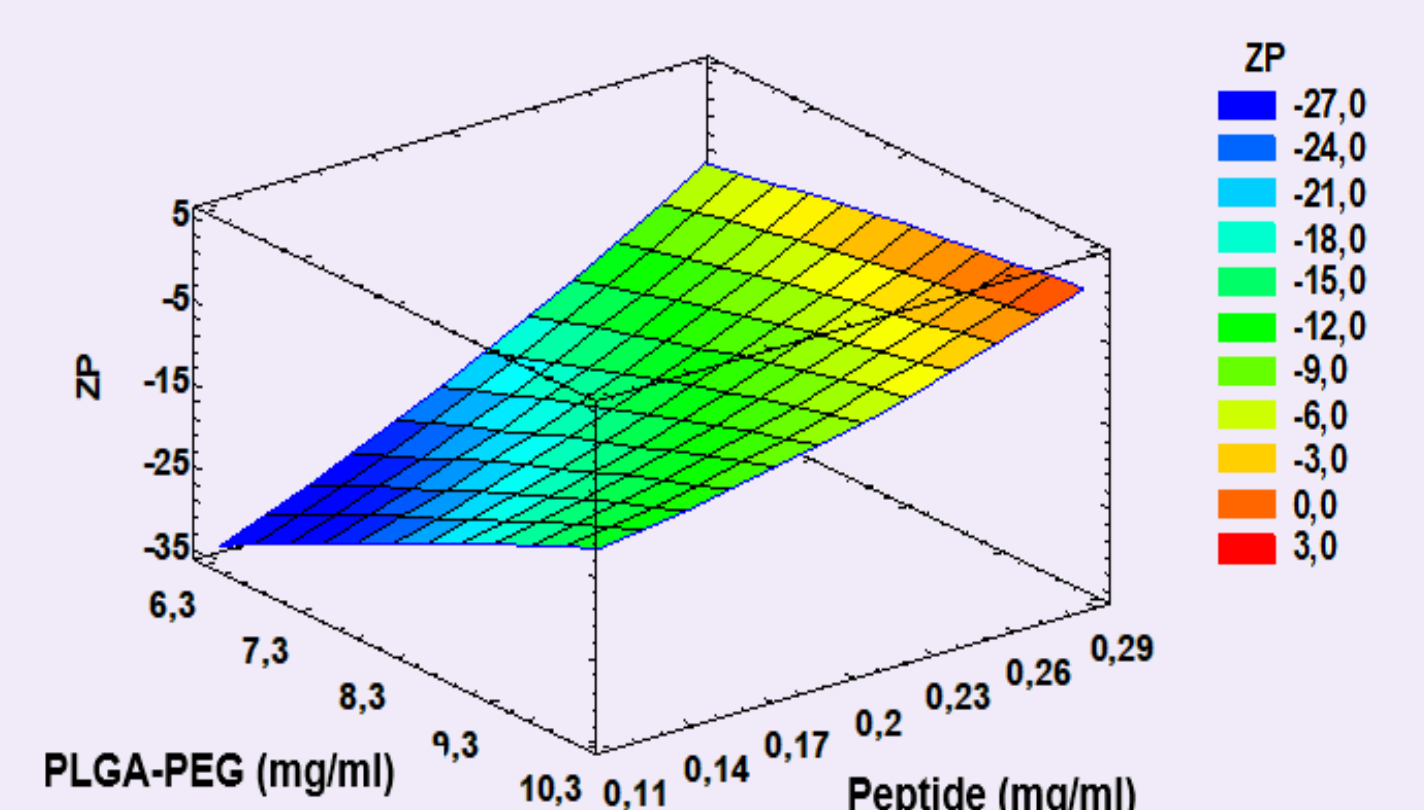


Fig.6 Graphs of response surface belonging to the factorial design for ZP

In the factorial design, it can be observed that the higher the concentration of PLGA-PEG and lutrol f-68, the lower the average sizes.

On the other hand, higher concentrations of lutrol f-68 cause an increase in the PI whereas a higher amount of PLGA-PEG decreases the PI. Moreover, when E1P47 concentration increases, a highly positive ZP value is obtained.

Encapsulation efficiency (EE) is above 95%.

PROPERTIES OF THE OPTIMIZED FORMULATION

	Chitosan (%)	Z _{av} (nm)	PI	ZP (mV)	EE (%)
E1P47 loaded NPs	0.038	320.5 ± 1.8	0.271 ± 0.003	47.2 ± 0.3	95.1 ± 0.3
Blank NPS	0.038	331.0 ± 0.5	0.238 ± 0.066	34.9 ± 0.1	-

RESULTS AND DISCUSSION

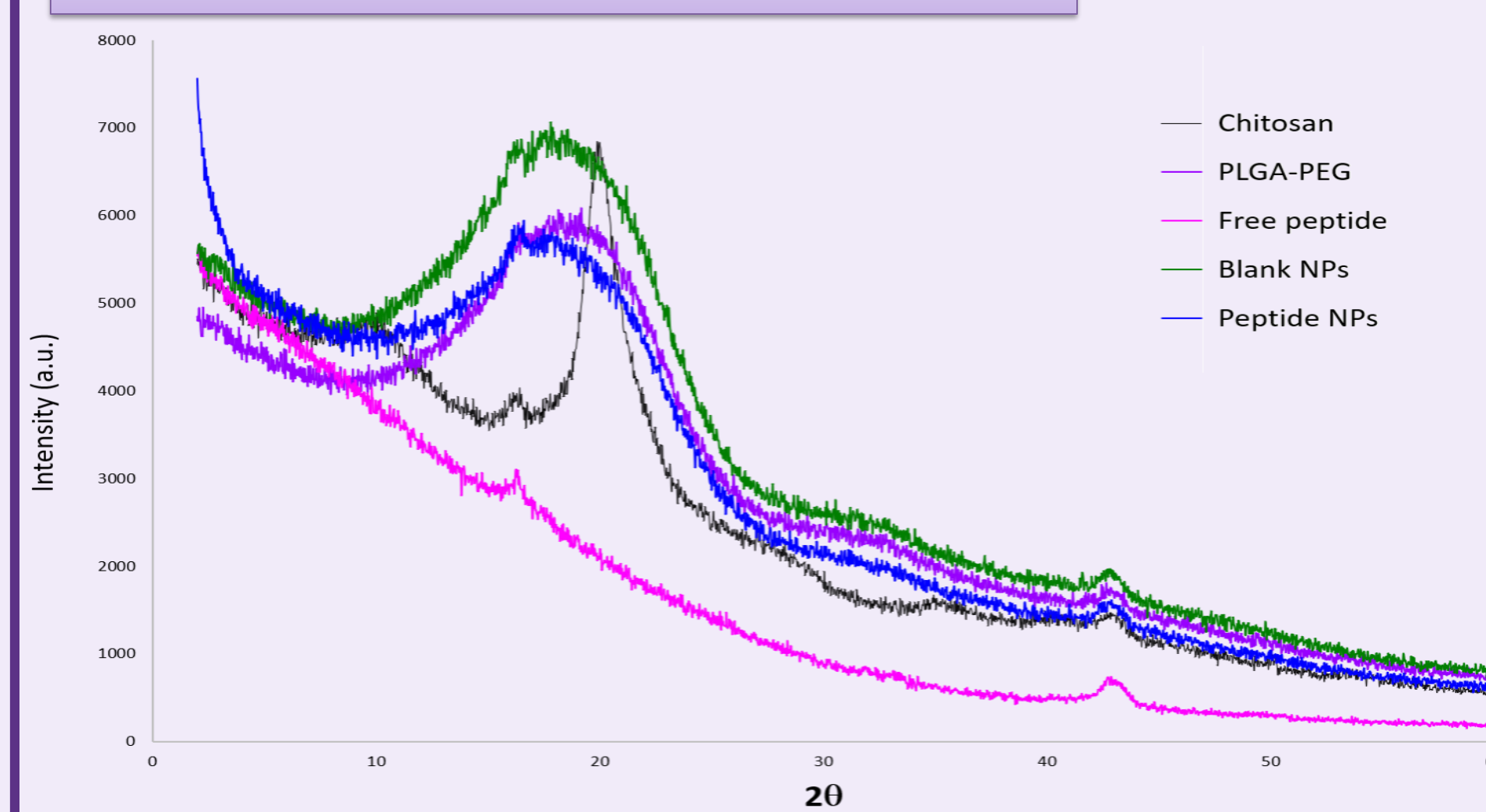


Fig.7 X-ray

X-ray diffraction show that all the components of the NPs loading E1P47 are amorphous and no crystalline structures were observed.

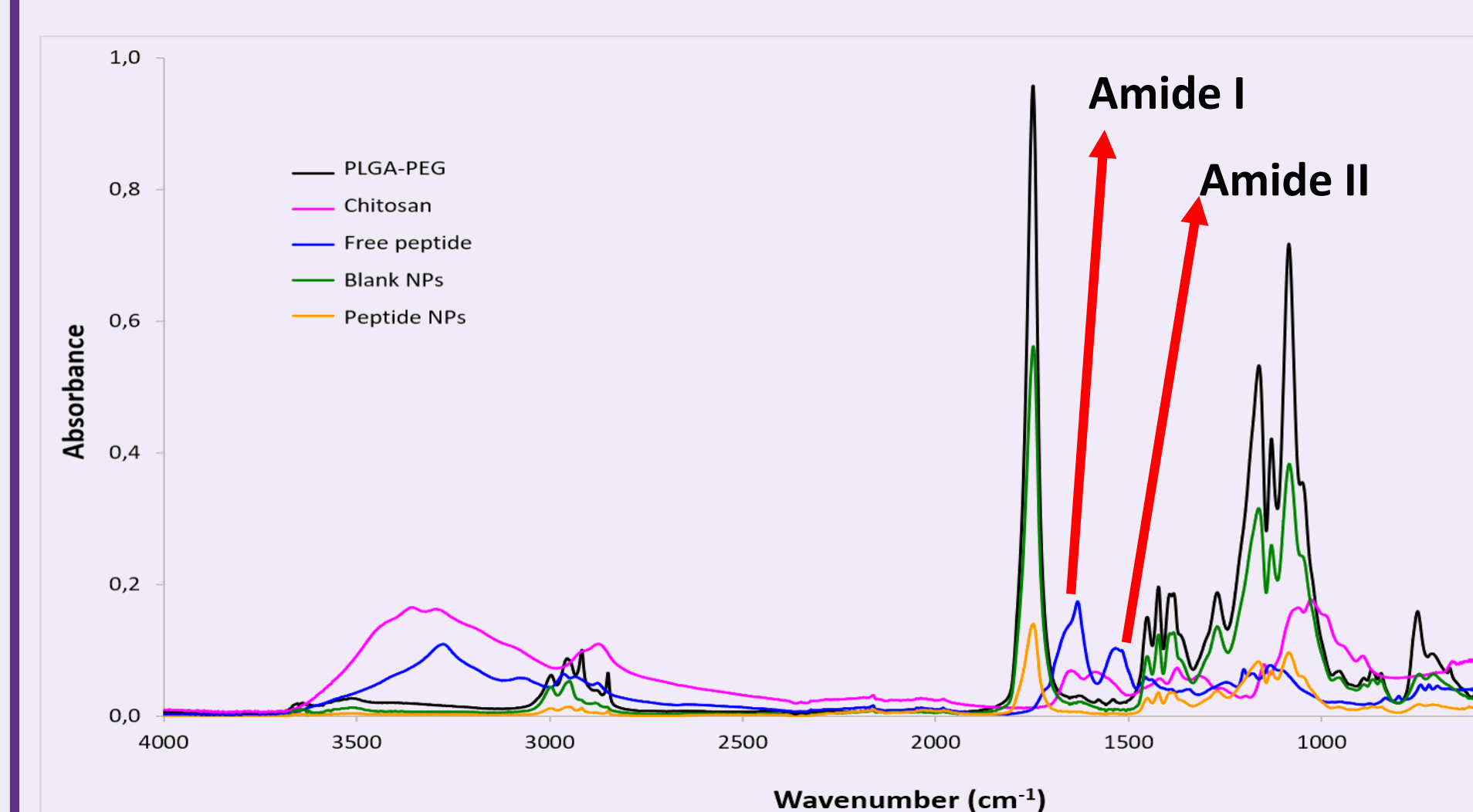


Fig.8 FTIR analysis

FTIR analysis shows bands corresponding to Amide I and Amide II, being the most sensitive spectral region of the secondary structure of polypeptides. No chemical bonds were formed by NPs loading E1P47.

CONCLUSION

An optimized formulation of NPs loading an anti-HIV-1 peptide has been obtained, with suitable properties in order to provide increased adherence of NPs to the vaginal mucosa. NPs size is lower than 400 nm, they possess a monomodal distribution, a highly positive ZP and an EE higher than 90%.

NPs loading E1P47 would be furtherly studied to confirm their microbicide properties.

REFERENCES

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