Supporting Information

Antimould action of Ziram and IPBC loaded in functionalized nanogels against *Aspergillus niger* and *Penicillium chrysogenum*

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(Materials Advances 2022)

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Solubility test of Ziram

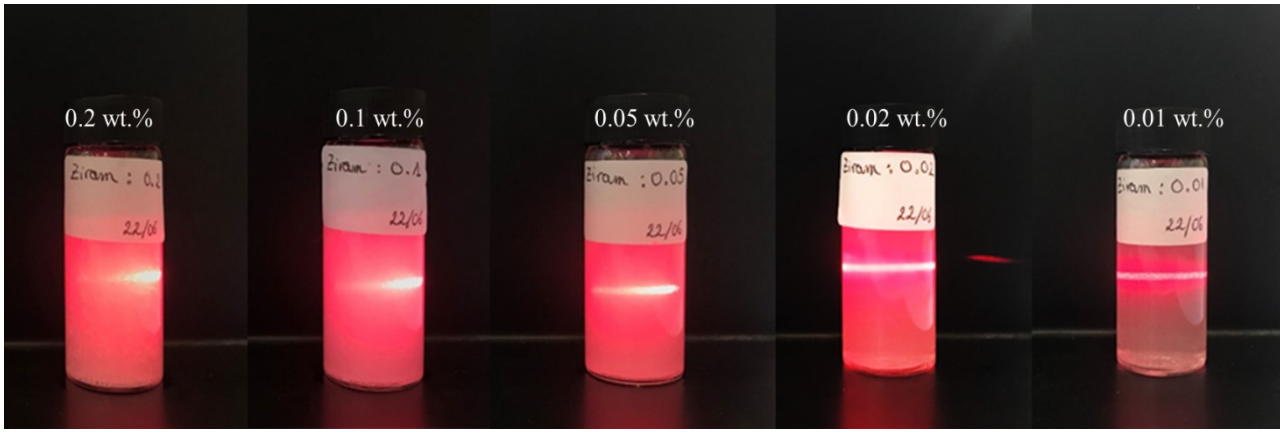

Figure S1. Ziram solubility test of: 0.2 wt. %, 0.1 wt.%, 0.05 wt. %, 0.02 wt.%, and 0.01 wt.% Ziram solutions at pH 8.

Solubility test of IPBC

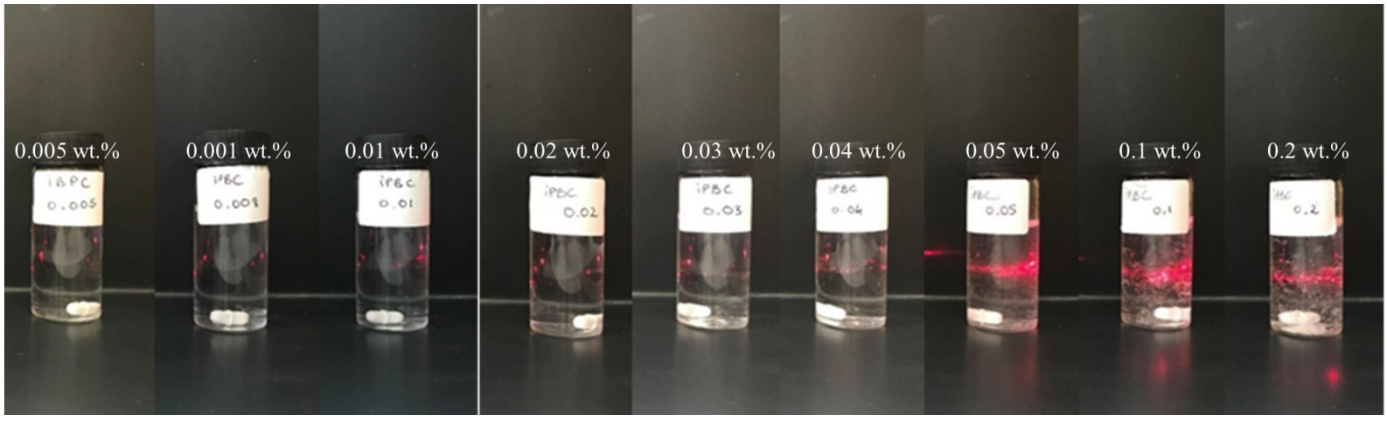

Figure S2. Digital photographs of the laser pointer test for IPBC solution samples at pH 8 after heating to 40 °C and lowering the temperature back to 25 °C. Concentrations from left to right: 0.005 wt.%, 0.008 wt.%, 0.01 wt.%, 0.02 wt.%, 0.03 wt.%, 0.04 wt.%, 0.05 wt.%, 0.1 wt.%, 0.2 wt.% IPBC. Above 0.04 wt.% IPBC the solution starts scattering light due to the presence of IPBC in a colloidal form.

Zeta potential and particle hydrodynamic radius of Carbopol nanogel loaded with Ziram and IPBC

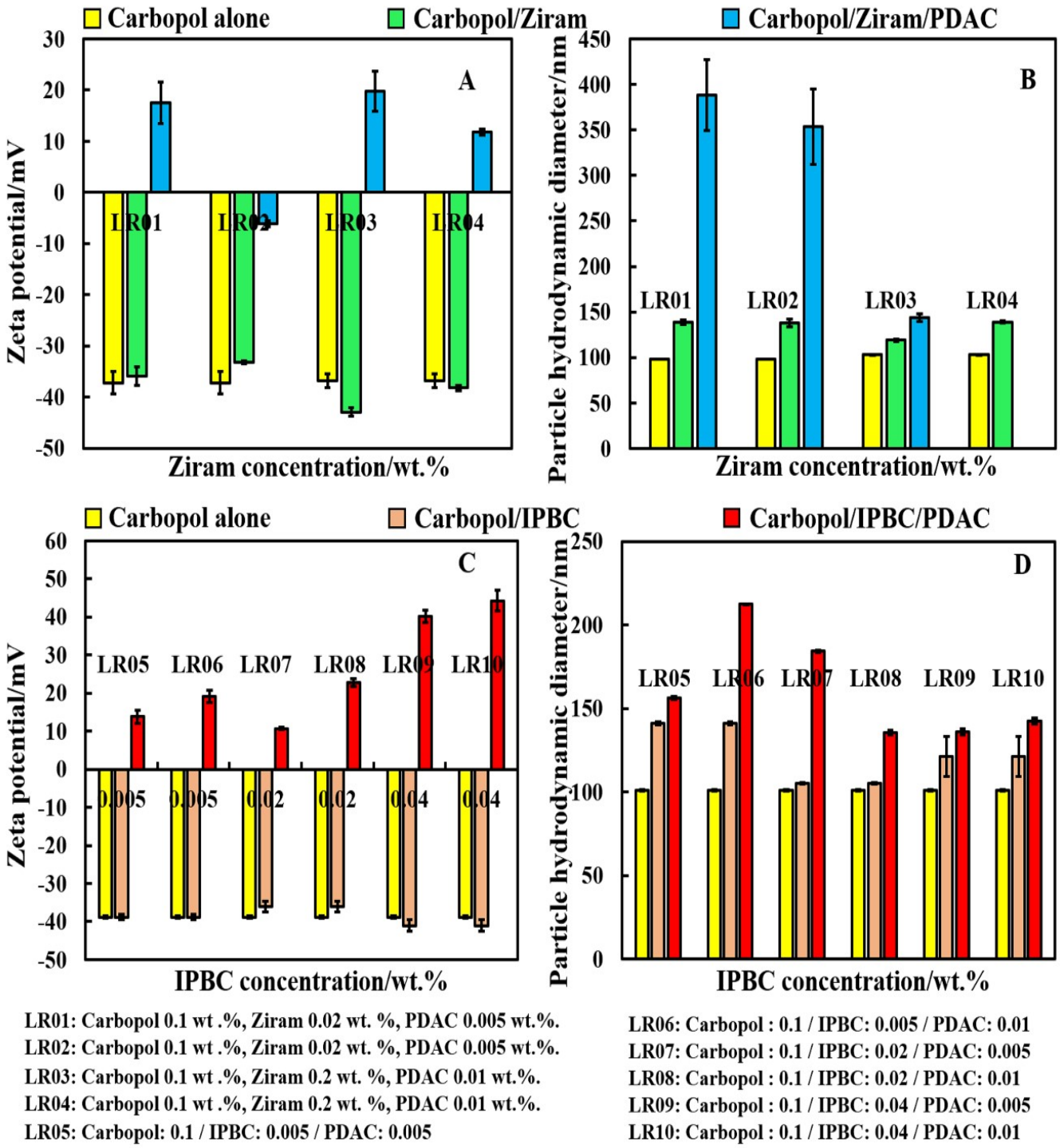

Figure S3. (A) The average particle hydrodynamic diameter and (B) zeta potential of the Carbopol Aqua SF1 nanogels loaded with various concentrations of the Ziram and coated with PDAC. (C) The average particle hydrodynamic diameter and (B) zeta potential of the Carbopol Aqua SF1 nanogels loaded with various concentrations of the IPBC and PDAC (error bars are the standard deviations).

The antimould activity of ziram and ziram-loaded Carbopol nanogels

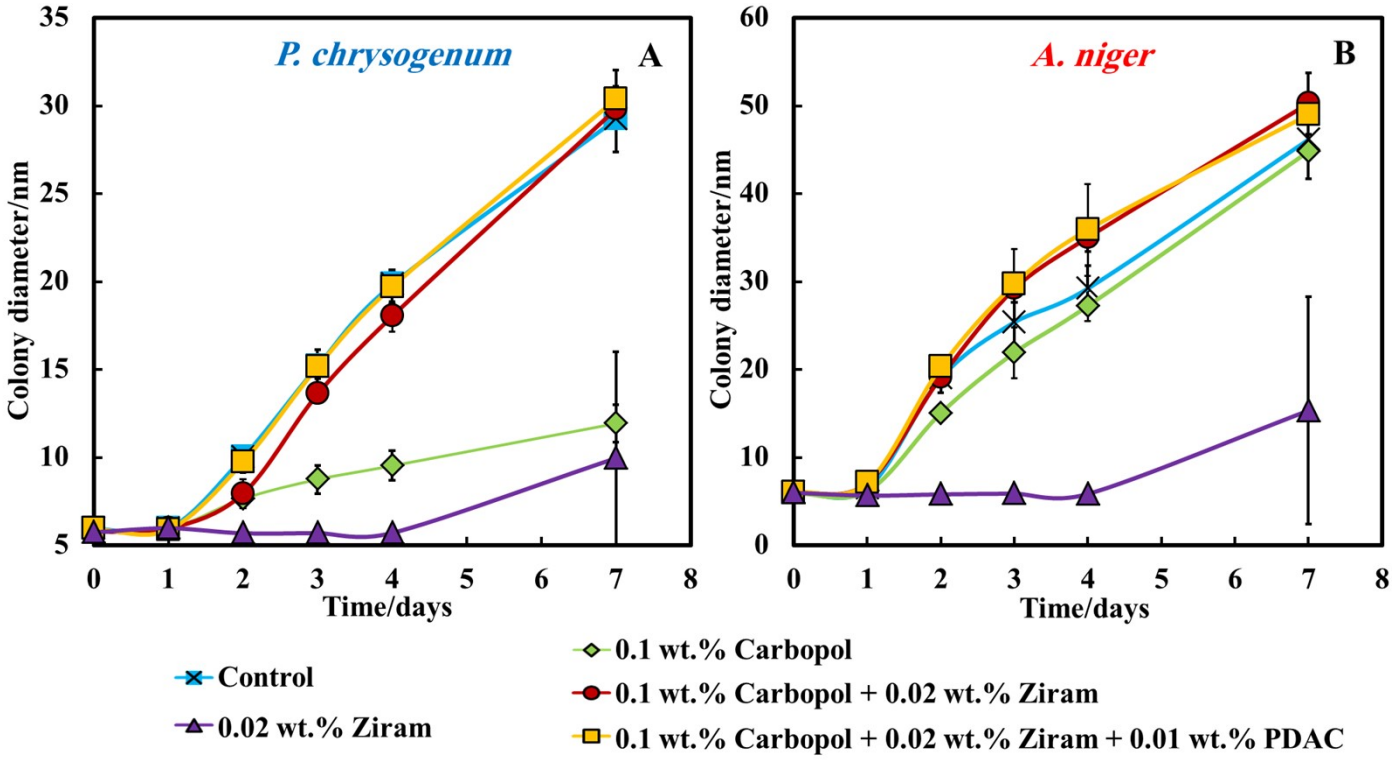

Figure S4. The diameter growth of *P. chrysogenum* (A) and *A. niger* (B) over the period of 4 days on PDA media with various concentrations of the Ziram and PDAC.

Method 1 – antimould agent on top of the growth media.

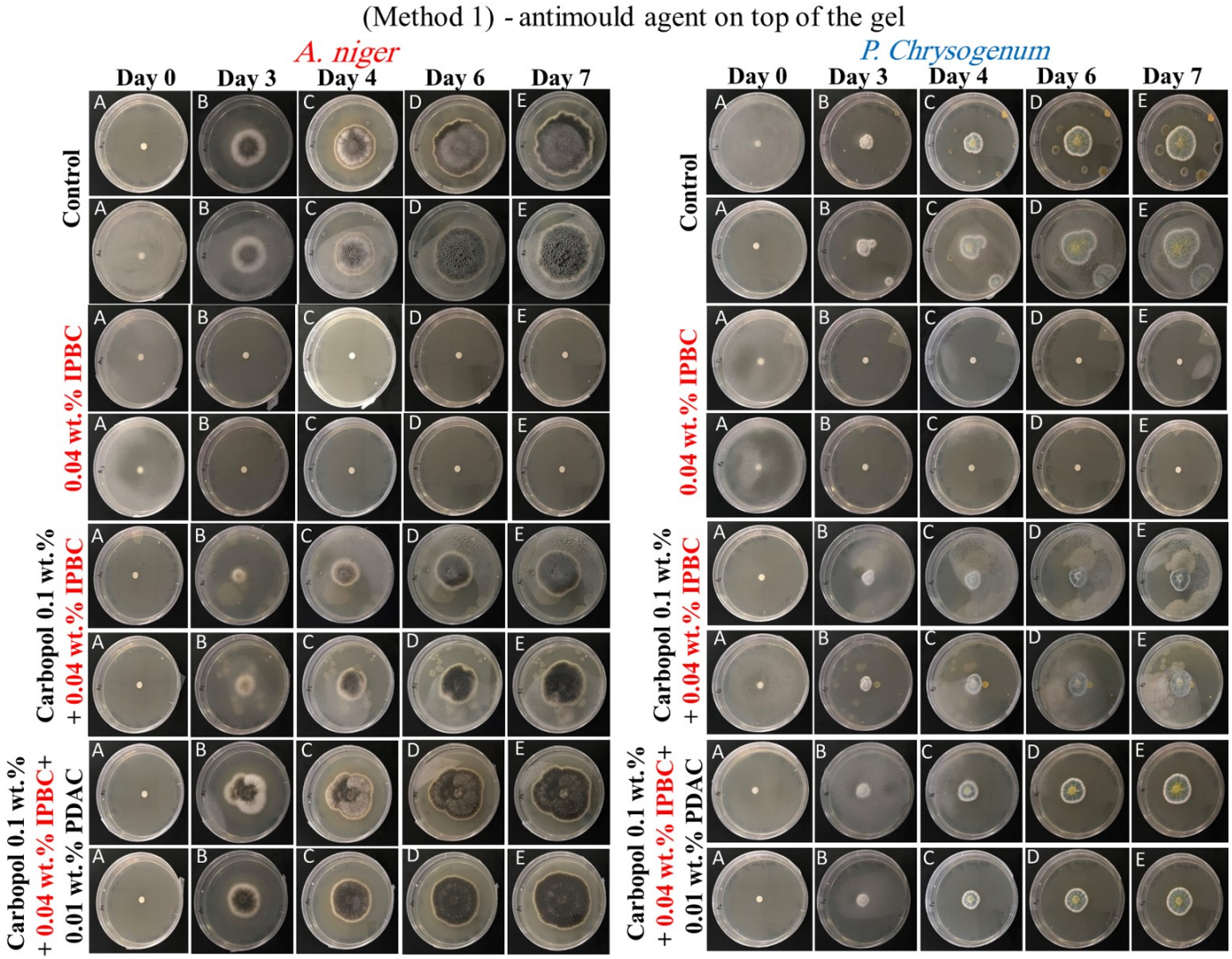

Figure S5. Digital photographs of the PGA-gel plates containing *A. niger* and *P. chrysogenum* and treated with free IPBC, IPBC encapsulated in 0.1 wt. % Carbopol, IPBC encapsulated in 0.1 wt. % Carbopol nanogel coated with 0.01 wt.% PDAC over the period of 7 days on PDA media. Method 1 was used for application of each of the antimould formulation. The growth is monitored every day at the same hour by measuring the diameter of the colony.

Method 2 – antimould agent (nanocarriers suspensions) in the bulk of the growth media.

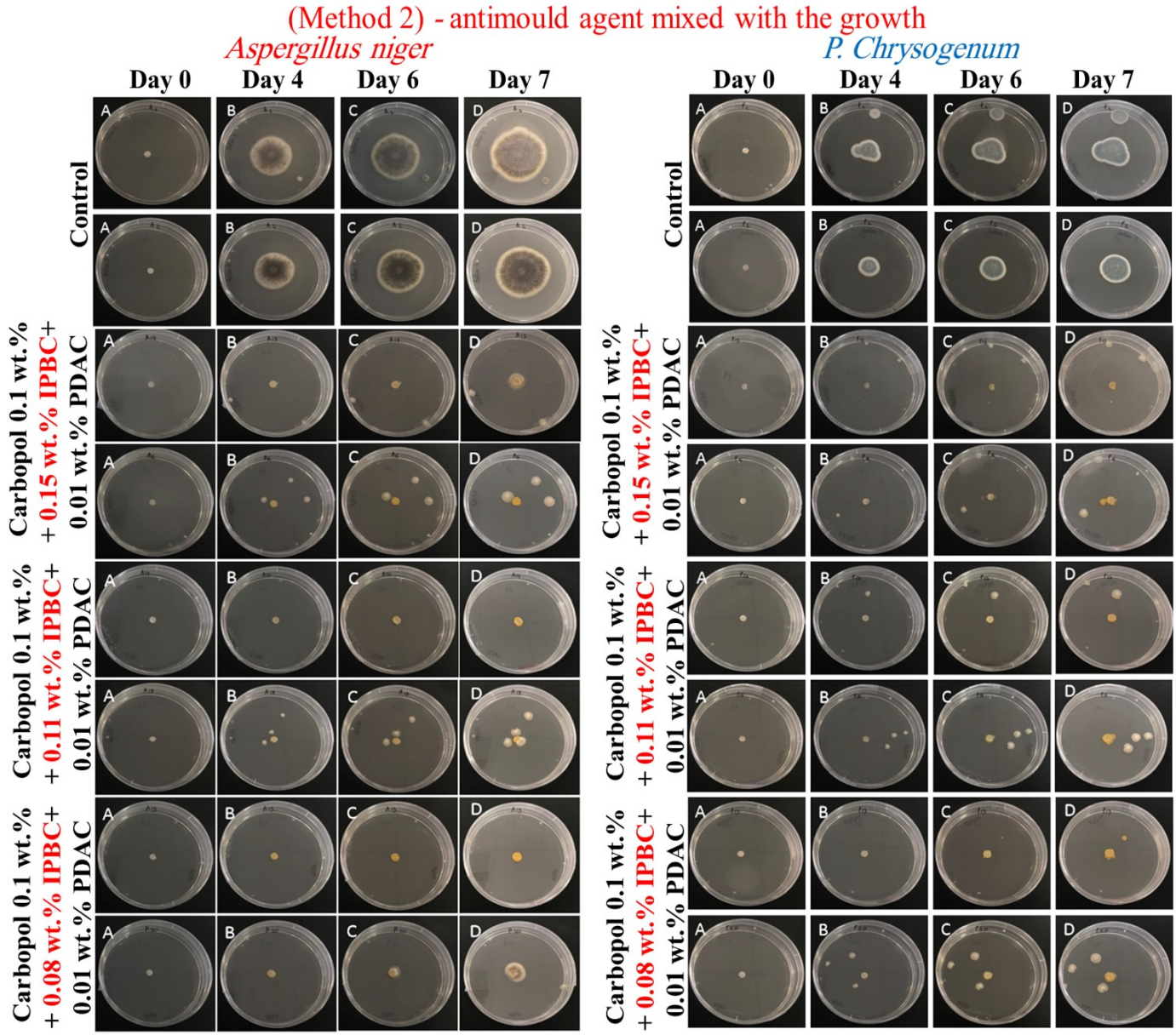

Figure S6. Digital photographs of the PDA gel plates containing *A. niger* and *P. chrysogenum* and treated with 3 different formulations of nanocarriers over the period of 7 days on PDA gel media. Method 2 consisted in preparing PDA media, autoclaving it, cooling to 40 °C and then and mixing it with antimould nanocarriers suspension, and finally pouring it in each Petri dishes to set at room temperature. Then, a sterile filter paper disk (5 mm in diameter) impregnated with the mould suspension was put in the centre of each Petri dish.

Method 3 – antimould agent (nanocarriers suspensions) in the bulk and the surface of the growth media.

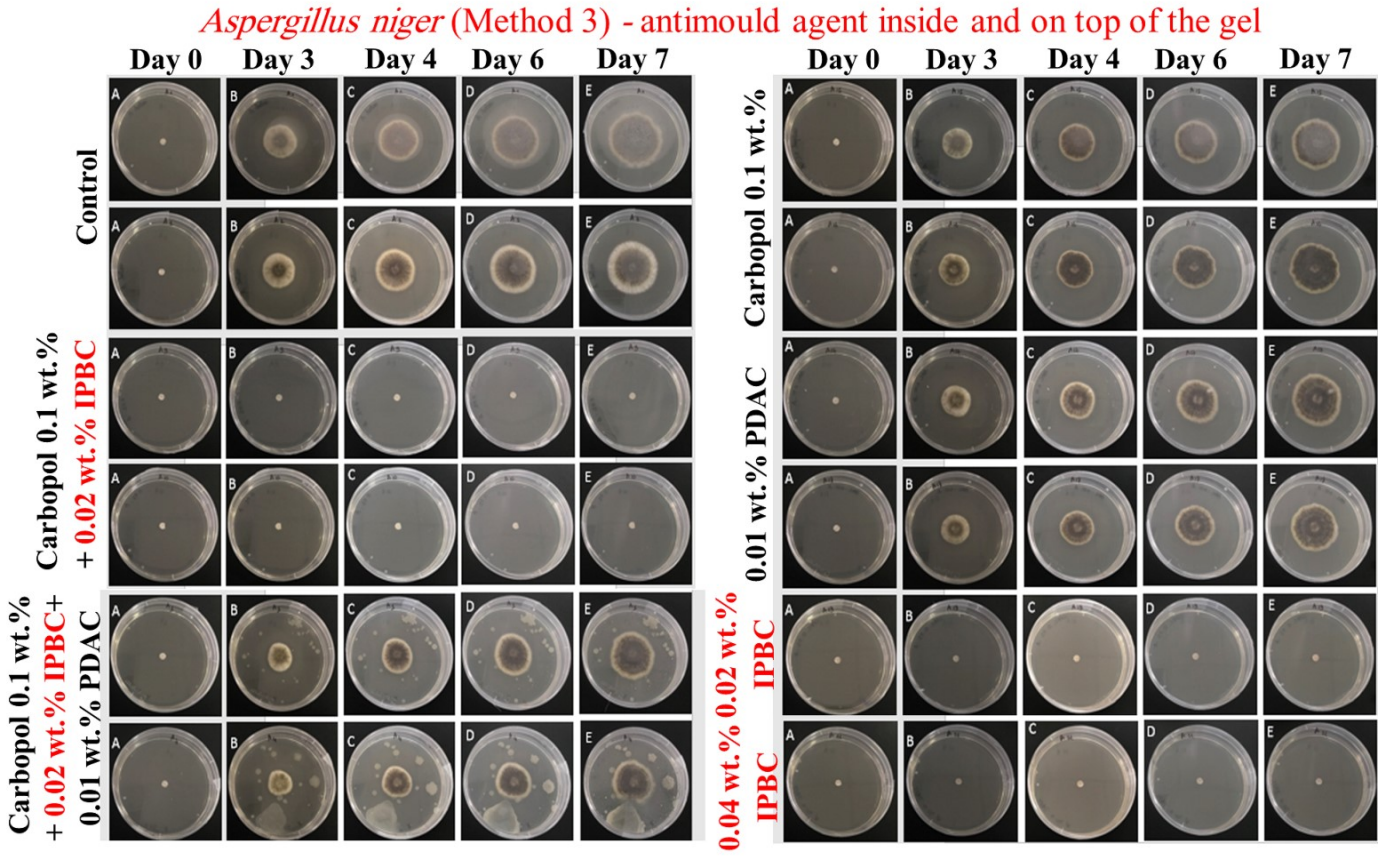

Figure S7. Digital photographs of the PDA-gel plates containing *A. niger* and treated with different formulations of nanocarriers over the period of 7 days on PDA gel media. Method 3 was used to apply the antimould formulations to the samples after which the mould colony growth was monitored for 7 days.

Table S1. Summary of the nanogel compositions studied for their antimould effect on *P. chrysogenum* and *A. niger*. The compositions of the Carbopol-loaded with Ziram- or IPBC with and without PDAC coating used.

Mould	Ziram-loaded Nanogel		IPBC-loaded Nanogel	
	PDAC-coated	Non-coated	PDAC-coated	Non-coated
P. chrysogenum	Carbopol 0.1 wt%+0.02wt% Ziram+0.01wt% PDAC	Carbopol 0.1 wt%+0.02wt% Ziram	Carbopol 0.1 wt%+0.04wt% IPBC+0.01wt% PDAC	Carbopol 0.1 wt%+0.02wt% IPBC
A. niger	Carbopol 0.1 wt%+0.02wt% Ziram+0.01wt% PDAC	Carbopol 0.1 wt%+0.02wt% Ziram	Carbopol 0.1 wt%+0.04wt% IPBC+0.01wt% PDAC	Carbopol 0.1 wt%+0.02wt% IPBC