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Supplementary Materials

Evaluation of Antimicrobial Activity and Cytotoxicity Effects of Extracts of *Piper nigrum* L. and Piperine

Fabrine Silva Alves [1], Jorddy Neves Cruz [2,*], Ingryd Nayara de Farias Ramos [3], Dayse Lucia do Nascimento Brandão [1], Rafael Nascimento Queiroz [2], Glauce Vasconcelos da Silva [2], Gleice Vasconcelos da Silva [2], Maria Fani Dolabela [1], Marcondes Lima da Costa [4], André Salim Khayat [3,5], José de Arimatéia Rodrigues do Rego [6] and Davi do Socorro Barros Brasil [1,2,6]

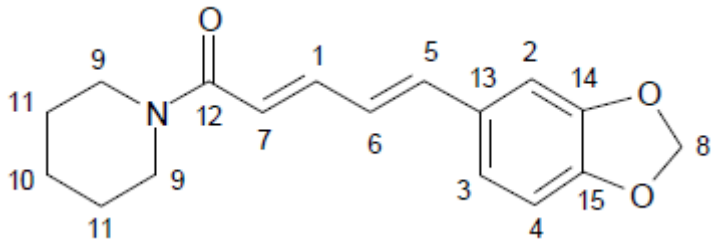

Figure S1. Molecular structure of Piperine.

The purity of the piperine compound (Figure S1) was confirmed by the ^{1}H and ^{13}C NMR data. In the spectra of the piperine componente, the following signals were observed: δ 24.69 (C-10), δ 25.53 (C11), δ 26.68 (C-11), δ 43.17 (C-9), δ 46.83 (C-9), δ 101.21 (C-8), δ 105.60 (C-2), δ 108.41 (C-4), δ 120.01 (C-7), δ 125.30 (C-3), δ 138.13 (C-5), δ 130.95 (C-13), δ 122.42 (C-6), δ 142.39 (C-1), δ 148.05 (C-14), δ 148.13 (C-15), δ 165.35 (C-12). The solvent signal was observed at around 76.5 ppm. All 13C-NMR values correlated accurately with the data reported in the literature (Figure S2).

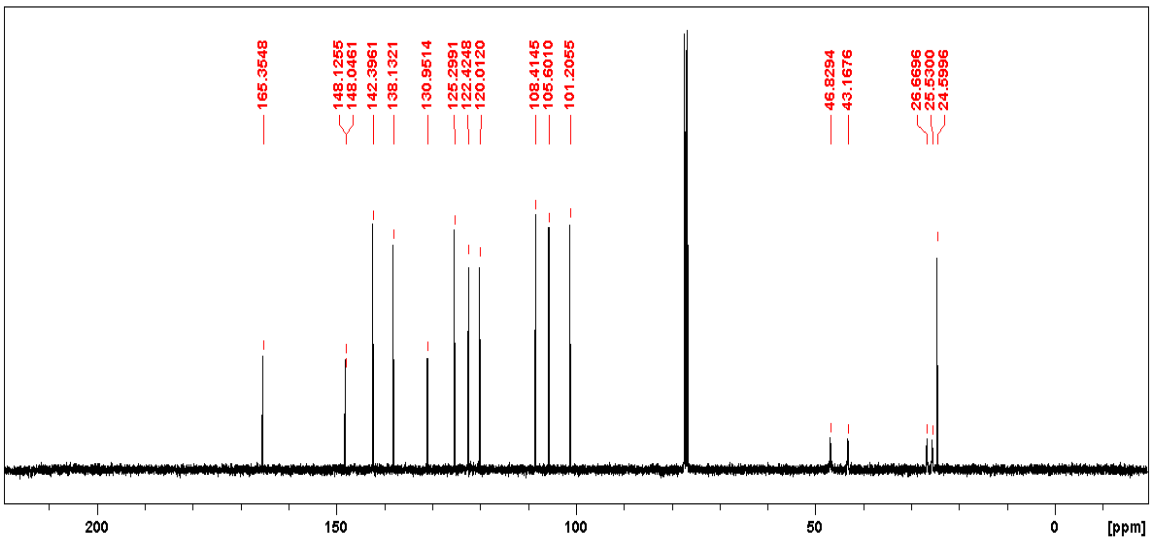

Figure S2. ^{13}C NMR spectrum obtained from analysis of piperine crystals.

The ^{1}H-NMR indicated 19 protons within the piperine compound, 12 are in the aliphatic region. In the ^{1}H-NMR spectra of the piperine component, the following signals were observed: δ 1.58–1.65 (4 H, m, 11-H), δ 1.56–1.59 (2 H, m, 10-H), δ 3.52–3.63 (4 H, m, 9-H), δ 5.95 (2 H, s, 8-H), δ 6.42 (1 H, d, 7-H), δ 6.73 (1 H, m, 6-H), δ 6.74 (1 H, m, 5-H), δ

6.76 (1 H, d, 4-H), δ 6.87 (1 H, dd, 3-H), δ 6.96 (1 H, m, 2-H), δ 7.36–7.40 (1 H, ddd, 1-H). Also, the solvent signal was observed at around 7.26 ppm. All ^{1}H-NMR values corresponded to the data reported in the literature (Muthurajan et al., 2014) (Figura S3).

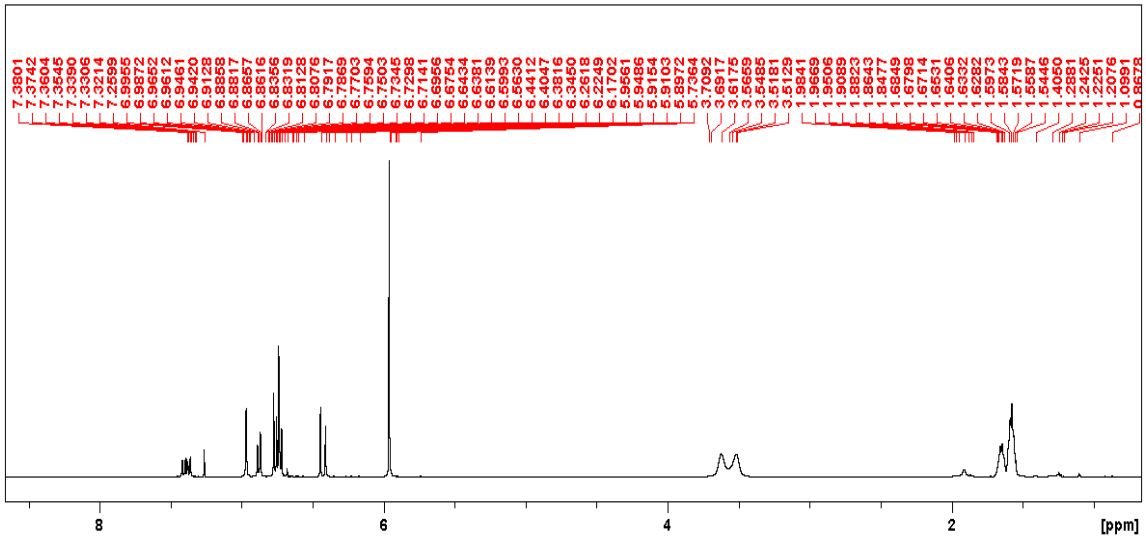

Figure S3. ^{1}H NMR spectrum obtained from analysis of piperine crystals.

The absorptions of the carbon atoms were verified in the bands of 24–165 ppm (Table S1). According to Thenmozhi and coworkers (2014) (Muthurajan, Mohanraj, Aravindan, Jayaprakash, & Thenmozhi, 2014) these bands suggest the presence of only aromatic and unsaturated carbon atoms in the molecule. Peaks in the 0–50 ppm range correspond to carbon–- carbon single bonds. The peak in the range of 101 ppm refers to the carbon-oxygen atom in the molecule. The bands of 100–150 ppm are due to the carbon–carbon double bonds and the absorption peak in the 165.35 ppm range is the carbon present in the carbon–oxygen double bond (Figure S1).

Table S1. NMR data (δ_C and δ_H) experimental (Exp.) in ppm for piperine.

Position	^{13}C	^{1}H
	Exp.	Exp.
1	142,4	7,4
2	105,6	7,0
3	125,3	6,9
4	108,4	6,8
5	138,1	6,7
6	122,4	6,7
7	120,0	6,4
8	101,2	6,0
9	43,17	3,6
9	46,83	-
10	24,69	1,6
11	25,53	1,6
11	26,68	-
12	165,4	-
13	131,0	-
14	148,1	-
15	148,1	-

(–) Data not available.