Semi self-doped electroconductive and biocompatible polyaniline/sulfonated β-cyclodextrin (PANI/SCD) inclusion complex with potential use in regenerative medicine

Yaser Arteshia,b,e, Ayuob Aghanejadb, Soodabeh Davarana,b,c\*, Yadollah Omidib,d\*

a Department of Medicinal Chemistry, Faculty of Pharmacy, Tabriz University of Medical Sciences, Tabriz, Iran

b Research Center for Pharmaceutical Nanotechnology, Biomedicine Institute, Tabriz University of Medical Sciences, Tabriz, Iran

c Drug Applied Research Center, Biomedicine Institute ,Tabriz University of Medical Sciences, Tabriz, Iran

d Department of Pharmaceutics, Faculty of Pharmacy, Tabriz University of Medical Sciences, Tabriz, Iran

e Student Research Committee, Tabriz University of Medical Sciences, Tabriz, Iran

Yaser Arteshi: E-mail: yaser.arteshi@gmail.com , Department of Medicinal Chemistry, Faculty of Pharmacy, Tabriz University of Medical Sciences, Daneshghah St. Post Code: 5166-15731, Tel:+98 41 33344763, Fax:+98 41 33344798, Tabriz, Iran.

Ayuob Aghanejad: E-mail: ayuob.aghanejad@gmail.com, , Research Center for Pharmaceutical Nanotechnology, Biomedicine Institute, Tabriz University of Medical Sciences, Daneshghah St. Post Code: 51656-65811, Tel: +98 41 33367914, Fax: +98 41 33367929, Tabriz, Iran.

Soodabeh Davaran: davaran@tbzmed.ac.ir, Department of Medicinal Chemistry, Faculty of Pharmacy, Tabriz University of Medical Sciences, Daneshghah St. Post Code: 5166-15731, Tel:+98 41 33344763, Fax:+98 41 33344798, Tabriz, Iran.

Yadollah Omidi: yomidi@tbzmed.ac.ir , Research Center for Pharmaceutical Nanotechnology, Biomedicine Institute, Tabriz University of Medical Sciences, Daneshghah St. Post Code: 51656-65811, Tel: +98 41 33367914, Fax: +98 41 33367929, Tabriz, Iran.

**Supplementary data:**

Table S 1- Two-way ANOVA test results and details for investigation of the simultaneous effect of extract concentration and component type on cytotoxicity of the HCl doped PANI, PANI/CD (1:1) and PANI/SCD (1:1), α=0.05.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Source of Variation | % of total variation | P value | P value summary | Significant? |  |
|  Interaction | 12.08 | < 0.0001 | \*\*\*\* | Yes |  |
|  Concentration of extract | 62.51 | < 0.0001 | \*\*\*\* | Yes |  |
|  Component type | 24.17 | < 0.0001 | \*\*\*\* | Yes |  |
|  Subjects (matching) | 0.2643 | 0.1322 | ns | No |  |
|  |  |  |  |  |  |
| ANOVA table | SS | DF | MS | F (DFn,DFd) | P value |
|  Interaction | 12473 | 12 | 1039 | F (12,54)=55.62 | P < 0.0001 |
|  Concentration of extract | 64531 | 6 | 10755 | F (6,54)=575.5 | P < 0.0001 |
|  Component type | 24948 | 2 | 12474 | F (2,9)=411.4 | P < 0.0001 |
|  Subjects (matching) | 272.9 | 9 | 30.32 | F (9,54)=1.622 | P = 0.1322 |
|  Residual | 1009 | 54 | 18.69 |  |  |

Table S 2- Two-way ANOVA test results and details for investigation of the simultaneous effect of extract concentration and component type on cytotoxicity of the dedoped PANI, PANI/CD (1:1) and PANI/SCD (1:1), α=0.05.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Source of Variation | % of total variation | P value | P value summary | Significant? |  |
|  Interaction | 3.604 | < 0.0001 | \*\*\*\* | Yes |  |
|  Concentration of extracts | 81.42 | < 0.0001 | \*\*\*\* | Yes |  |
| Component type | 13.85 | < 0.0001 | \*\*\*\* | Yes |  |
|  Subjects (matching) | 0.2167 | 0.1996 | ns | No |  |
|  |  |  |  |  |  |
| ANOVA table | SS | DF | MS | F (DFn, DFd) | P value |
|  Interaction | 2219 | 12 | 184.9 | F (12, 54) = 17.81 | P < 0.0001 |
|  Concentration of extracts | 50133 | 6 | 8355 | F (6, 54) = 804.6 | P < 0.0001 |
|  Component type | 8526 | 2 | 4263 | F (2, 9) = 287.5 | P < 0.0001 |
|  Subjects (matching) | 133.4 | 9 | 14.83 | F (9, 54) = 1.428 | P = 0.1996 |
|  Residual | 560.8 | 54 | 10.38 |  |  |

Table S 3-Tukey`s multiple comparision test results and details for investigation of the effect of time on cytotoxicity of the PANI/SCD-D (1:1) for within 72h.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Tukey's multiple comparisons test | Mean Diff. | 95% CI of diff. | Significant? | Summary |
|  |  |  |  |  |
|  RV |  |  |  |  |
|  24h vs. 48h | -5.72E-06 | -7.074 to 7.074 | No | ns |
|  24h vs. 72h | 1.91E-06 | -7.074 to 7.074 | No | ns |
|  48h vs. 72h | 7.63E-06 | -7.074 to 7.074 | No | ns |
|  |  |  |  |  |
| 1% |  |  |  |  |
|  24h vs. 48h | 0.9318 | -6.142 to 8.006 | No | ns |
|  24h vs. 72h | 6.21 | -0.8644 to 13.28 | No | ns |
|  48h vs. 72h | 5.278 | -1.796 to 12.35 | No | ns |
|  |  |  |  |  |
| 5% |  |  |  |  |
|  24h vs. 48h | 5.227 | -1.847 to 12.30 | No | ns |
|  24h vs. 72h | 19.87 | 12.80 to 26.95 | Yes | \*\*\*\* |
|  48h vs. 72h | 14.64 | 7.570 to 21.72 | Yes | \*\*\*\* |
|  |  |  |  |  |
| 10% |  |  |  |  |
|  24h vs. 48h | 0.3057 | -6.768 to 7.380 | No | ns |
|  24h vs. 72h | 14.7 | 7.622 to 21.77 | Yes | \*\*\*\* |
|  48h vs. 72h | 14.39 | 7.316 to 21.46 | Yes | \*\*\*\* |
|  |  |  |  |  |
| 25% |  |  |  |  |
|  24h vs. 48h | 4.666 | -2.408 to 11.74 | No | ns |
|  24h vs. 72h | 15.86 | 8.782 to 22.93 | Yes | \*\*\*\* |
|  48h vs. 72h | 11.19 | 4.116 to 18.26 | Yes | \*\*\* |
|  |  |  |  |  |
| 50% |  |  |  |  |
|  24h vs. 48h | 7.449 | 0.3751 to 14.52 | Yes | \* |
|  24h vs. 72h | 18.13 | 11.06 to 25.21 | Yes | \*\*\*\* |
|  48h vs. 72h | 10.68 | 3.611 to 17.76 | Yes | \*\* |
|  |  |  |  |  |
| 100% |  |  |  |  |
|  24h vs. 48h | 0.5497 | -6.524 to 7.624 | No | ns |
|  24h vs. 72h | 9.117 | 2.042 to 16.19 | Yes | \*\* |
|  48h vs. 72h | 8.567 | 1.493 to 15.64 | Yes | \* |

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test details | Mean 1 | Mean 2 | Mean Diff. | SE of diff. | N1 | N2 | q | DF |
|  |  |  |  |  |  |  |  |  |
|  RV |  |  |  |  |  |  |  |  |
|  24h vs. 48h | 100 | 100 | -5.72E-06 | 2.947 | 4 | 4 | 2.75E-06 | 63 |
|  24h vs. 72h | 100 | 100 | 1.91E-06 | 2.947 | 4 | 4 | 9.15E-07 | 63 |
|  48h vs. 72h | 100 | 100 | 7.63E-06 | 2.947 | 4 | 4 | 3.66E-06 | 63 |
|  |  |  |  |  |  |  |  |  |
| 1% |  |  |  |  |  |  |  |  |
|  24h vs. 48h | 83.42 | 82.48 | 0.9318 | 2.947 | 4 | 4 | 0.4471 | 63 |
|  24h vs. 72h | 83.42 | 77.21 | 6.21 | 2.947 | 4 | 4 | 2.98 | 63 |
|  48h vs. 72h | 82.48 | 77.21 | 5.278 | 2.947 | 4 | 4 | 2.533 | 63 |
|  |  |  |  |  |  |  |  |  |
| 5% |  |  |  |  |  |  |  |  |
|  24h vs. 48h | 72.53 | 67.31 | 5.227 | 2.947 | 4 | 4 | 2.508 | 63 |
|  24h vs. 72h | 72.53 | 52.66 | 19.87 | 2.947 | 4 | 4 | 9.535 | 63 |
|  48h vs. 72h | 67.31 | 52.66 | 14.64 | 2.947 | 4 | 4 | 7.027 | 63 |
|  |  |  |  |  |  |  |  |  |
| 10% |  |  |  |  |  |  |  |  |
|  24h vs. 48h | 64.27 | 63.97 | 0.3057 | 2.947 | 4 | 4 | 0.1467 | 63 |
|  24h vs. 72h | 64.27 | 49.58 | 14.7 | 2.947 | 4 | 4 | 7.052 | 63 |
|  48h vs. 72h | 63.97 | 49.58 | 14.39 | 2.947 | 4 | 4 | 6.905 | 63 |
|  |  |  |  |  |  |  |  |  |
| 25% |  |  |  |  |  |  |  |  |
|  24h vs. 48h | 44.52 | 39.85 | 4.666 | 2.947 | 4 | 4 | 2.239 | 63 |
|  24h vs. 72h | 44.52 | 28.66 | 15.86 | 2.947 | 4 | 4 | 7.609 | 63 |
|  48h vs. 72h | 39.85 | 28.66 | 11.19 | 2.947 | 4 | 4 | 5.37 | 63 |
|  |  |  |  |  |  |  |  |  |
| 50% |  |  |  |  |  |  |  |  |
|  24h vs. 48h | 38.64 | 31.19 | 7.449 | 2.947 | 4 | 4 | 3.575 | 63 |
|  24h vs. 72h | 38.64 | 20.5 | 18.13 | 2.947 | 4 | 4 | 8.702 | 63 |
|  48h vs. 72h | 31.19 | 20.5 | 10.68 | 2.947 | 4 | 4 | 5.127 | 63 |
|  |  |  |  |  |  |  |  |  |
| 100% |  |  |  |  |  |  |  |  |
|  24h vs. 48h | 23.86 | 23.31 | 0.5497 | 2.947 | 4 | 4 | 0.2638 | 63 |
|  24h vs. 72h | 23.86 | 14.74 | 9.117 | 2.947 | 4 | 4 | 4.375 | 63 |
|  48h vs. 72h | 23.31 | 14.74 | 8.567 | 2.947 | 4 | 4 | 4.111 | 63 |

Table S 4- Two-way ANOVA test results and details for investigation of the simultaneous effect of extract concentration and time on cytotoxicity of the PANI/SCD-D (1:1) for within 72h, α=0.05.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Source of Variation | % of total variation | P value | P value summary | Significant? |  |
|  Interaction | 1.114 | 0.002 | \*\* | Yes |  |
|  Concentration of extract | 93.62 | < 0.0001 | \*\*\*\* | Yes |  |
|  Time | 3.519 | < 0.0001 | \*\*\*\* | Yes |  |
|  Subjects (matching) | 0.1416 | 0.846 | ns | No |  |
|  |  |  |  |  |  |
| ANOVA table | SS | DF | MS | F (DFn, DFd) | P value |
|  Interaction | 699 | 12 | 58.25 | F (12, 54) = 3.128 | P = 0.0020 |
|  Concentration of extract | 58761 | 6 | 9794 | F (6, 54) = 525.9 | P < 0.0001 |
|  Time | 2209 | 2 | 1104 | F (2, 9) = 111.8 | P < 0.0001 |
|  Subjects (matching) | 88.88 | 9 | 9.876 | F (9, 54) = 0.5304 | P = 0.8460 |
|  Residual | 1006 | 54 | 18.62 |  |  |