Anti-tuberculosis activity research of 5-(thiophen-2-ylmethyl)-4H-1,2,4-triazole-3-thiol

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A – research concept and design; B – collection and/or assembly of data; C – data analysis and interpretation; D – writing the article; E – critical revision of the article; F – final approval of the article

Introduction. 1,2,4-Triazole derivatives have already proven themselves to be compounds with low toxicity and high antimicrobial, antifungal, antiviral, hepatoprotective activity.

The aim of work is to research the anti-tuberculosis activity of 5-(thiophen-2-ylmethyl)-4H-1,2,4-triazoles-3-thiol on the bacteria strain M. bovis.

Materials and methods. At the beginning of the experiment, the effect of the drug concentration and the pH of the medium on the growth rate of the culture at 37 °C was detected. M. bovis 100 passage was selected for this purpose, which was cultured at 37 °C with 5-(thiophen-2-ylmethyl)-4H-1,2,4-triazole-3-thiol at the indicated concentrations in a thermostat for 3 months on medium with pH 6.5 (ten test tubes with each medicine concentration) and pH 7.1 (ten test tubes with each medicine concentration). M. bovis 100 passage was used as a control without the addition of 5-(thiophen-2-ylmethyl)-4H-1,2,4-triazole-3-thiol to the medium.

Results. The results of the experiment show that the effect of the drug at different concentrations on the medium with a pH 6.5 same with pH 7.1.

Growth of pathogenic strain M. bovis 100 passages throughout the observation period (90 days) have been absence for all of the test (0.1 %, 0.5 % and 1.0 %) concentrations of 5-(thiophen-2-ylmethyl)-4H-1,2,4-triazoles-3-thiol.

Conclusion. It can be concluded that 0.1 %, 0.5 % and 1.0 % concentration of 5-(thiophen-2-ylmethyl)-4H-1,2,4-triazole-3-thiol influence on the culture properties pathogenic strain M. bovis, which cultured on the medium with pH 6.5 and pH 7.1 at 37 °C, while holding back growth, having a tuberculostatic effect.
Исследование противотуберкулезной активности 5-(тиофен-2-илметил)-4H-1,2,4-триazole-3-тиола

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Одной из основных проблем в современной оперативной и терапевтической медицине и фармации являются заболевания, вызванные микробными инфекциями. Производные 1,2,4-триазола зарекомендовали себя как соединения с низкой токсичностью и высоким противомикробным, противогрибковым, противовирусным, гепатопротекторным действием.

Цель работы — исследование противотуберкулезной активности 5-(тиофен-2-илметил)-4H-1,2,4-триazole-3-тиола на бактерии штамма M. bovis.

Материалы и методы. В начале опыта исследовали влияние концентрации препарата и рН среды на интенсивность роста культуры при температуре 37 °C. Для этого отбирали M. bovis 100 пассажа, который культивировали при температуре 37 °C с 5-(тиофен-2-илметил)-4H-1,2,4-триazole-3-тиолом в указанных концентрациях в терmostatе в течение 3 месяцев в среде с рН 6.5 (10 пробирок с каждой концентрацией препарата) и рН 7.1 (10 пробирок с каждой концентрацией препарата). В качестве контроля использовали M. bovis 100 пассажа без добавления к среде 5-(тиофен-2-илметил)-4H-1,2,4-триazole-3-тиола.

Результаты. Таким образом, 0,1 %, 0,5 % и 1,0 % концентрации 5-(тиофен-2-илметил)-4H-1,2,4-триazole-3-тиола активно влияют на культуральные свойства патогенного штамма M. bovis, культивируемого на среде с рН 6,5 и рН 7,1 при температуре 37 °C, сдерживая рост и развитие, обладая туберкулостатическими действиями.

Ключевые слова: 1,2,4-триазол, противотуберкулезная активность, гетероциклические соединения.

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### Table 1. Characterization of the cultural properties of *M. bovis* 100 passage, which cultured on medium with a pH 7.1 at 37 °C

| Day of experience | Control | The concentration of 5-(thiophen-2-ylmethyl)-4H-1,2,4-triazole-3-thiol |
|-------------------|---------|-----------------------------------------------------------------------|
| 7th day of experience | A rough raid | 0.1 %: There is no growth, 0.5 %: There is no growth, 1.0 %: There is no growth |
| 14th day of experience | Rough raid and single white colonies along the sowing line | 0.1 %: There is no growth, 0.5 %: There is no growth, 1.0 %: There is no growth |
| 30th day of experience | Solid growth, Smooth, small colonies of whitish color | Unchanged, Unchanged, Unchanged |
| 60th day of experience | Solid growth, Smooth, small colonies of whitish color | 0.1 %: There is no growth, 0.5 %: There is no growth, 1.0 %: There is no growth |
| 90th day of experience | Solid growth | Unchanged, Unchanged, Unchanged |

### Table 2. Characterization of the cultural properties of 100 passages of *M. bovis*, which cultured on medium with a pH of 7.1 at 37 °C

| Day of experience | Control | The concentration of the drug isoniazid |
|-------------------|---------|----------------------------------------|
| 7th day of experience | Mucoid plaque | 0.1 %: Mucoids plaque is yellow, 0.5 %: Mucoids plaque, 1.0 %: There is no growth |
| 14th day of experience | Unchanged | Unchanged, Single smooth colonies, There is no growth |
| 30th day of experience | Numerous colonies are white | Single colonies are whitish, Small colonies are white, There is no growth |
| 60th day of experience | Solid growth, Smooth, small colonies of whitish color | The number of single small colonies increased slightly, Small colonies are white, There is no growth |
| 90th day of experience | Solid growth | Solid growth, The number of single small colonies increased slightly, There is no growth |

### Table 3. Characterization of the cultural properties of *M. bovis* 100 passage, cultured on medium with pH 6.5 at 37 °C

| Day of experience | Control | The concentration of 5-(thiophen-2-ylmethyl)-4H-1,2,4-triazole-3-thiol |
|-------------------|---------|-----------------------------------------------------------------------|
| 7th day of experience | Single colonies along the sowing line | 0.1 %: There is no growth, 0.5 %: There is no growth, 1.0 %: There is no growth |
| 14th day of experience | Solid growth. Colonies are small, white, smooth | There is no growth, There is no growth, There is no growth |
| 30th day of experience | Solid growth. Colonies are small, white, smooth | There is no growth, There is no growth, There is no growth |
| 60th day of experience | Solid growth. Colonies are small, white, smooth | There is no growth, There is no growth, There is no growth |
| 90th day of experience | Solid growth. Colonies are small, white, smooth | There is no growth, There is no growth, There is no growth |

### Table 4. Characterization of the cultural properties of 100 passages of *M. bovis* cultured on medium with pH of 6.5 with isoniazid at 37 °C

| Day of experience | Control | The concentration of the medicine isoniazid |
|-------------------|---------|---------------------------------------------|
| 7th day of experience | Mucoid plaque | 0.1 %: Single colonies are whitish, 0.5 %: A rough raid, 1.0 %: There is no growth |
| 14th day of experience | Single colonies whitish color | Unchanged, Single smooth colonies, There is no growth |
| 30th day of experience | Numerous colonies are white | Single colonies are whitish, Small colonies are white, Single small colonies along the sowing line |
| 60th day of experience | Solid growth. Colonies are small, white, smooth | Growth of whitish, single smooth colonies, Growth of whitish, single smooth colonies, Unchanged |
| 90th day of experience | Solid growth. Colonies are small, white, smooth | The number of single small colonies increased, The number of single small colonies increased, The number of single small colonies increased |
Table 3 summarizes the data on the cultural properties of *M. bovis* 100 passage, which was cultured in a medium with pH 6.5, which contained 5-(thiophen-2-ylmethyl)-4H-1,2,4-triazole-3-thiol in three concentrations.

Until the 7th day of the experiment, the growth of all test cultures in the medium with pH 6.5 at 37 °C was not observed. The results of the experiment show that the effect of the substance at different concentrations on the medium with pH 6.5 and pH 7.1 are the same. It was marked lack of growth of pathogenic strain *M. bovis* 100 passages throughout the observation period (90 days) for all test (0.1 %, 0.5 % and 1.0 %) concentrations of 5-(thiophen-2-ylmethyl)-4H-1,2,4-triazole-3-thiol. Thus, it can be concluded that 0.1 %, 0.5 % and 1.0 % concentration of 5-(thiophen-2-ylmethyl)-4H-1,2,4-triazole-3-thiol actively influence the culture properties pathogenic strain *M. bovis* cultured on medium with pH 6.5 at 37°C, which holding back growth and having a tuberculostatic effect.

The low concentration (0.1 % and 0.5 %) of the medicine isoniazid on the medium with pH 6.5 and 7.1 at 37°C was not inhibited the growth of pathogenic *M. bovis* 100th passage unlike 5-(thiophen-2-ylmethyl)-4H-1,2,4-triazole-3-thiol. Thus, tables 1-4 had shown that 5-(thiophen-2-ylmethyl)-4H-1,2,4-triazole-3-thiol had higher anti-tuberculosis activity than the medicine isoniazid.

**Conclusions**

Thus, it can be concluded that 0.1 %, 0.5 % and 1.0 % concentration of 5-(thiophen-2-ylmethyl)-4H-1,2,4-triazole-3-thiol actively influence the culture properties pathogenic strain *M. bovis* cultured on medium with pH 6.5 at 37 °C, which holding back growth and having a tuberculostatic effect.

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