

Niclosamide Sustained Release Tablets with a Long-term Effect Based on Expanded Graphite

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Abstract. Niclosamide sustained release tablets with a long-term effect based on expanded graphite were prepared. Their sustained release properties were determined by using UV/VIS spectroscopy. The results show that the release rate of niclosamide decreases with the increase of the content of graphite in the sustained release tablets. The niclosamide can continue to release more than 80 days when the graphite content in sustained release tablets is less than 43%.

Introduction

Wettable powder of 50% niclosamide ethanolamine salt (WPN) has the effect of killing Oncomelania snails and inhibiting their climbing. In order to prevent Oncomelania snails from diffusing the snail retention tanks can be set along the canals [1]. The effects may be enhanced if a niclosamide sustained release tablet with a long-term effect was used in the snail retention tanks. In our previous research aminophylline sustained release tablets based on expanded graphite have been prepared [2]. This study is aimed at attempting to prepare niclosamide sustained release tablets with a long-term effect based on expanded graphite. The expanded graphite was used as a slow-release material, and wettable powder of 50% niclosamide ethanolamine salt (WPN) as a slow-release object.

Materials and Method

Preparation of Expanded Graphite

In order to prepare expanded graphite, natural flake graphite (carbon content: 98%, grain size: -80~+200) was immersed in a homogeneous mixture of conc. HNO₃ and conc. H₂SO₄ (v/v: 1/40). The reaction temperature and reaction time were controlled at 60°C for 1 h. In the meantime the reactants were stirred twice, each for 5 minutes. The expandable graphite can be obtained by washing the flake graphite powder product with running water for 2 hours and then drying it in an oven for 48 hrs at 60°C. The worm-like expanded graphite can be obtained by heating the expandable graphite at 1100°C for 15 seconds in a muffle furnace.

Preparation of the Niclosamide Sustained Release Tablets Based on Expanded Graphite

Wettable powder of 50% niclosamide ethanolamine salt (WPN) solution was sprayed onto the expanded graphite. After WPN solution was absorbed by expanded graphite completely the mixture of WPN and expanded graphite powder was put in a vacuum dryer, and then was dried under vacuum conditions at room temperature. The niclosamide sustained release tablets were prepared by means of direct compression of the dried mixture.

Evaluation of the Sustained Release Properties of the Prepared Tablets

One niclosamide sustained release tablet was placed in a gas collecting bottle and then fill the bottle with 250ml distilled water. The dissolution experiment was controlled at room temperature. The water will be replaced every 24hrs and the concentration of niclosamide in the water was determined by a UV spectrometry (Optizen UV2120, Korea). After a period of release processing the concentration of niclosamide in the water decreased gradually and the interval of the replacement of

water would be prolonged. It was determined that the wavelength for niclosamide concentration detection was 210nm. The linear regression equation ($Y=0.07631X+0.04415$, X is absorbance %, Y is concentration of niclosamide $\mu\text{g/ml}$) was got by using the least squares method.

Results and Discussion

Preparation of Niclosamide Sustained Release Tablets with a Long-term Effect

Expanded graphite has porous and fluffy structure, so the WPN solution can be well absorbed by the expanded graphite. Figure 1 shows the mixture of expanded graphite and WPN. The niclosamide sustained release tablets can be easily prepared just by compressing the mixtures of expanded graphite and WPN. Figure 2 shows the appearance of self-made niclosamide sustained release tablets. Experimental results show that the niclosamide sustained release tablets do not disintegrate in liquid because the expanded graphite forms a continuous network structure.

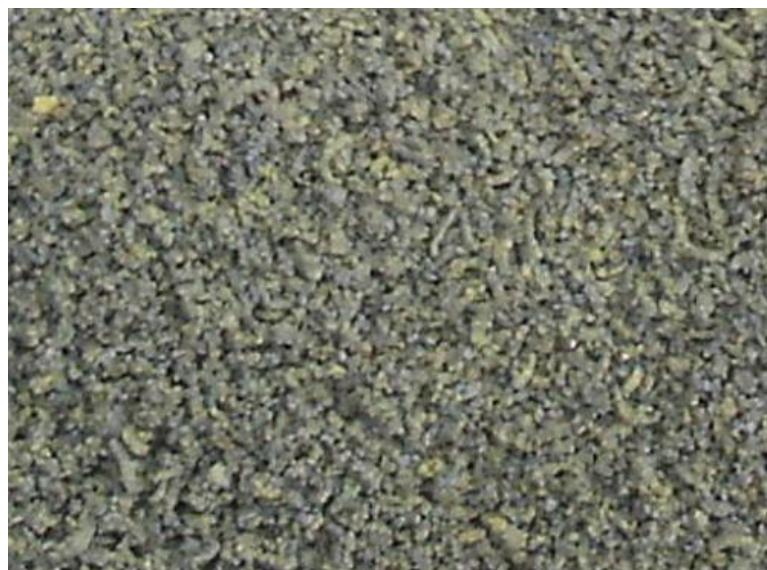


Fig. 1. The photograph of dispersion state of WPN in the expanded graphite



Fig. 2. The photograph of self-made niclosamide sustained release tablets

Influence of Graphite Content on Sustained Release Properties of Prepared Tablets

Niclosamide sustained release tablets with expanded graphite content being 20%, 24%, 33%, 43%, 54% respectively were prepared, while the WPN content in each tablet is 0.1g. Figure 3 shows

the influence of graphite content on the sustained release properties of niclosamide sustained release tablets.

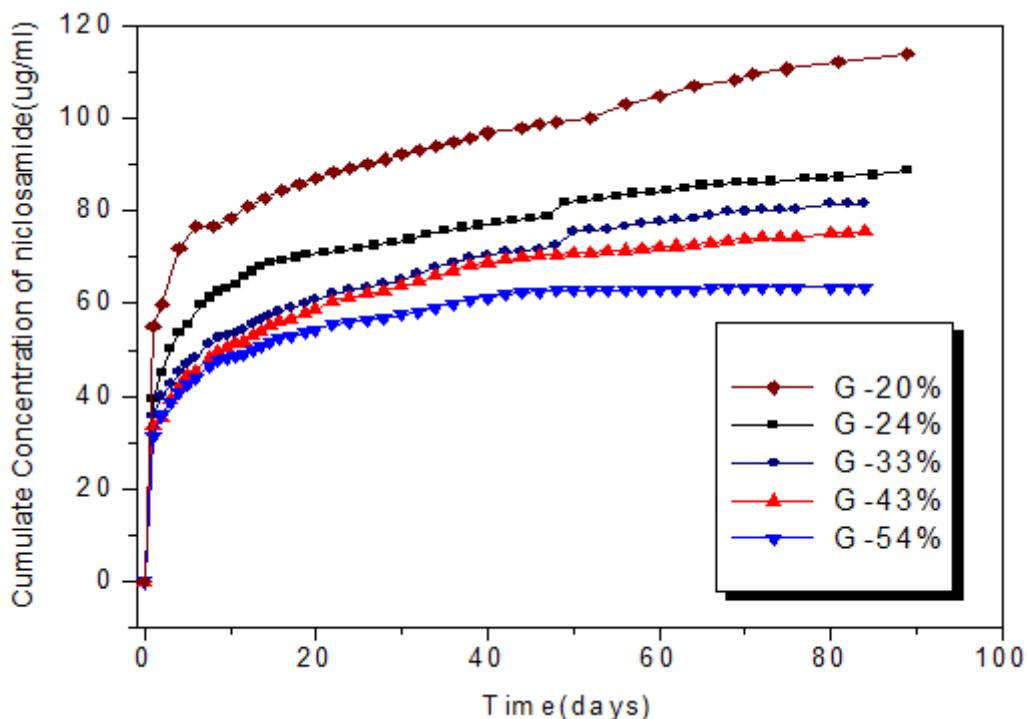


Fig. 3. Influence of graphite content on sustained release properties

It can be seen in Figure 3 that the release rate of niclosamide decreases with the increase of the content of graphite. The release of niclosamide can last for more than 80 days when the graphite content in sustained release tablets is less than 43%, which means that the niclosamide sustained release tablets based on expanded graphite are the sustained release tablets with a long-term effect. The release of niclosamide lasts no more than 50 days when the graphite content is 54%, which means part of the niclosamide in the niclosamide sustained release tablets cannot release when a sustained release tablet is high in graphite.

Structure of Graphite Matrix of Niclosamide Sustained Release Tablets based on Expanded Graphite

According to the results above it is clear that the expanded graphite can be used as a potential slow-release material. Expanded graphite has porous and fluffy structure, so the WPN solution can be well absorbed by the expanded graphite. The WPN will be encapsulated by expanded graphite when the mixture of WPN and expanded graphite powder is compressed into a tablet. The graphite matrix of the sustained release tablets will reduce the release rate of WPN. Figure 4 and Figure 5 show the SEM photograph of graphite matrix of the sustained release tablets.

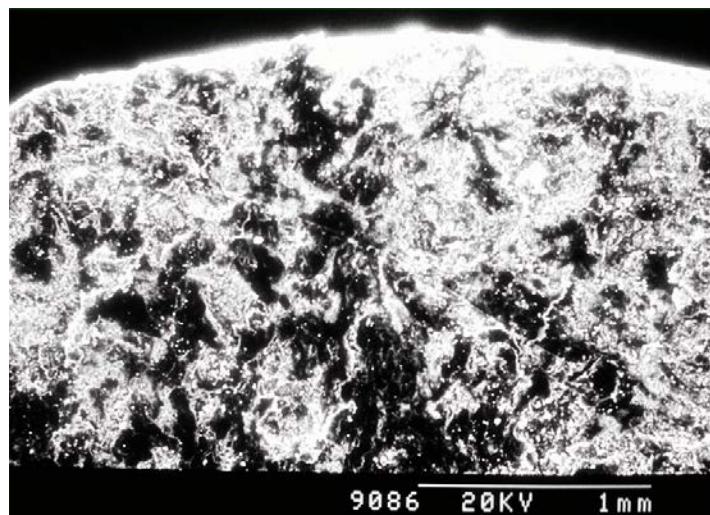


Fig. 4. SEM photograph of graphite matrix of the sustained release tablet

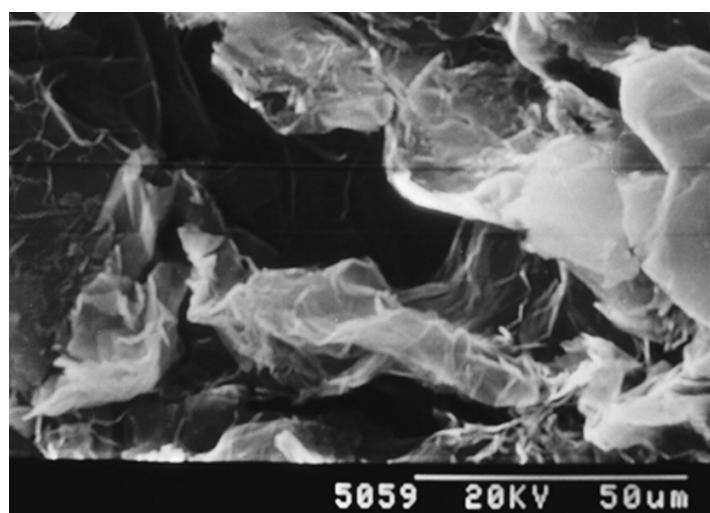


Fig. 5. Microstructure of graphite matrix of the sustained release tablet

It can be seen in Figure 5 that there are many pores or channels in graphite matrix. These pores may be filled with WPN before WPN releases. Part of WPN may be sealed completely in the graphite matrix when a sustained release tablet is high in graphite.

Summary

The expanded graphite can be used as a potential slow-release material. The results show that the release rate of niclosamide decreases with the increase of the content of graphite in the sustained release tablets. The release of niclosamide can last more than 80 days when the graphite content in sustained release tablets is less than 43%.

References

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