Pharmacological properties of Centella asiatica hydrogel in accelerating wound healing in rabbits

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Abstract

Background Various extracts of Centella asiatica (Apiaceae) and its active constituent, asiaticoside, have been reported to possess wound healing property when assessed using various in vivo and in vitro models. In an attempt to develop a formulation with accelerated wound healing effect, the present study was performed to examine in vivo efficacy of asiaticoside-rich hydrogel formulation in rabbits. Methods Asiaticoside-rich fraction was prepared from C. asiatica aerial part and then incorporated into polyvinyl alcohol/polyethylene glycol (PVA/PEG) hydrogel. The hydrogel was subjected to wound healing investigation using the in vivo incision model. Results The results obtained demonstrated that: i) the hydrogel formulation did not cause any signs of irritation on the rabbits' skin and; ii) enhanced wound healing 15% faster than the commercial cream and > 40% faster than the untreated wounds. The skin healing process was seen in all wounds marked by formation of a thick epithelial layer, keratin, and moderate formation of granulation tissues, fibroblasts and collagen with no fibrinoid necrosis detected. Conclusion The asiaticoside-rich hydrogel developed using the freeze-thaw method was effective in accelerating wound healing in rabbits.

Keywords

Author Keywords: Asiaticoside; Centella asiatica; Apiaceae; Hydrogel film; Wound dressing; Wound healing; PVA/PEG
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Cited References: 30

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1. PVA-PEG physically cross-linked hydrogel film as a wound dressing: experimental design and optimization — Times Cited: 21
By: Ahmed, Afnan Sh.; Mandal, Uttam Kumar; Taher, Muhammad; et al.
PHARMACEUTICAL DEVELOPMENT AND TECHNOLOGY Volume: 23 Issue: 8 Pages: 751-760 Published: 2018

2. A statistical analysis of murine incisional and excisional acute wound models — Times Cited: 37
By: Ansell, David M.; Campbell, Laura; Thomason, Helen A.; et al.
WOUND REPAIR AND REGENERATION Volume: 22 Issue: 2 Pages: 281-287 Published: MAR 2014

3. In vitro and In vivo wound healing studies of methanolic fraction of Centella asiatica extract — Times Cited: 13
By: Azis, H. A.; Taher, M.; Ahmed, A. S.; et al.
SOUTH AFRICAN JOURNAL OF BOTANY Volume: 108 Pages: 163-174 Published: JAN 2017

4. Wound healing dressings and drug delivery systems: A review — Times Cited: 1,207
By: Boateng, Joshua S.; Matthews, Kerr H.; Stevens, Howard N. E.; et al.
JOURNAL OF PHARMACEUTICAL SCIENCES Volume: 97 Issue: 8 Pages: 2892-2923 Published: AUG 2008

5. Centella asiatica in Dermatology: An Overview — Times Cited: 42
By: Bylka, Wieslawa; Znajdek-Awizen, Paulina; Studzinska-Sroka, Elzbieta; et al.
PHYTOTHERAPY RESEARCH Volume: 28 Issue: 8 Pages: 1117-1124 Published: AUG 2014

6. Centella asiatica in cosmetology — Times Cited: 32
By: Bylka, Wieslawa; Znajdek-Awizen, Paulina; Studzinska-Sroka, Elzbieta; et al.
POSTEPY DERMATOLOGII I ALERGOLOGII Volume: 30 Issue: 1 Pages: 46-49 Published: 2013

7. Effects of topical applications of porcine acellular urinary bladder matrix and Centella asiatica extract on oral wound healing in a rat model — Times Cited: 1
By: Camacho-Alonso, Fabio; Torralba-Ruiz, M. R.; Garcia-Carrillo, N.; et al.
CLINICAL ORAL INVESTIGATIONS Volume: 23 Issue: 5 Pages: 2083-2095 Published: MAY 2019

8. Biological properties of the chitosan-gelatin sponge wound dressing — Times Cited: 86
By: Deng, Chun-Mei; He, Lan-Zhen; Zhao, Ming; et al.
CARBOHYDRATE POLYMERS Volume: 69 Issue: 3 Pages: 583-589 Published: JUN 25 2007

9. Basic science of wound healing — Times Cited: 111
By: Enoch, S; Leaper, DJ.
Surgery Volume: 26 Issue: 2 Pages: 31-7 Published: 2008

10. Title: [not available] — Times Cited: 5
By: Enoch, S.; Leaper, D.J.
Surgery (Oxford) Volume: 26 Pages: 31-37 Published: 2005

11. Centella asiatica: phytochemistry and mechanisms of neuroprotection and cognitive enhancement — Times Cited: 11
By: Gray, Nora E.; Magana, Armando Alcazar; Lak, Parnian; et al.
PHYTOCHEMISTRY REVIEWS Volume: 17 Issue: 1 Pages: 161-194 Published: FEB 2018

12. Effect of *Achillea millefolium* extract in wound healing of rabbit. — Times Cited: 12
By: Hemmati, A. A.; Arzi, A.; Amin, M.
Journal of Natural Remedies Volume: 2 Issue: 2 Pages: 164-167 Published: 2002

13. Advanced formulation and pharmacological activity of hydrogel of the titrated extract of C-Asiatica — Times Cited: 32
By: Hong, SS; Kim, JH; Li, H; et al.
ARCHIVES OF PHARMACAL RESEARCH Volume: 28 Issue: 4 Pages: 502-508 Published: APR 2005

14. Gentamicin-Loaded Wound Dressing With Polyvinyl Alcohol/Dextran Hydrogel: Gel Characterization and In Vivo Healing Evaluation — Times Cited: 72
By: Hwang, Ma-Ro; Kim, Jong Oh; Lee, Jeong Hoon; et al.
AAPS PHARMSCITECH Volume: 11 Issue: 3 Pages: 1092-1103 Published: SEP 2010

15. Aqueous extract of Centella asiatica promotes corneal epithelium wound healing in vitro — Times Cited: 32
By: Idrus, Ruszymah Bt Hj; Chowdhury, Shiplu Roy; Manan, Nur Azeanty Bt Abdul; et al.
JOURNAL OF ETHNOPHARMACOLOGY Volume: 140 Issue: 2 Pages: 333-338 Published: MAR 27 2012

16. **Facilitating action of asiaticoside at low doses on burn wound repair and its mechanism** — Times Cited: 58
By: Kimura, Yoshiyuki; Sumiyoshi, Maho; Samukawa, Kei-ichi; et al.
EUROPEAN JOURNAL OF PHARMACOLOGY Volume: 584 Issue: 2-3 Pages: 415-423 Published: APR 28 2008

17. **PVA-clay nanocomposite hydrogels for wound dressing** — Times Cited: 347
By: Kokabi, Mehrdad; Sirousazar, Mohammad; Hassan, Zuhair Muhammad
EUROPEAN POLYMER JOURNAL Volume: 43 Issue: 3 Pages: 773-781 Published: MAR 2007

18. **The morphological and pharmacological effects of asiaticoside upon skin in vitro and in vivo** — Times Cited: 19
By: LAWRENCE, J. S.
EUR J PHARMACOL Volume: 1 Issue: (5) Pages: 414-424 Published: 1967

19. **Design and evaluation of drug-loaded wound dressing having thermo responsive, adhesive, absorptive and easy peeling properties** — Times Cited: 99
By: Lin, SY; Chen, KS; Liang, RC
BIOMATERIALS Volume: 22 Issue: 22 Pages: 2999-3004 Published: NOV 2001

20. **Dermal fibroblast-associated gene induction by asiaticoside shown in vitro by DNA microarray analysis** — Times Cited: 34
By: Lu, L; Ying, K; Wei, S; et al.
BRITISH JOURNAL OF DERMATOLOGY Volume: 151 Issue: 3 Pages: 571-578 Published: SEP 2004

21. **Nutritional support for wound healing.** — Times Cited: 211
By: MacKay, Douglas; Miller, Alan L
Alternative medicine review : a journal of clinical therapeutic Volume: 8 Issue: 4 Pages: 359-77 Published: 2003-Nov

22. Title: [not available] — Times Cited: 1
Group Author(s): OECD
OECD Guideline for Testing of Chemicals: Acute Dermal Irritation/Corrosion Volume: 404 Published: 2015
Retrieved July 7, 2019

23. **EFFECT OF ASIATICOSIDE ON WOUND HEALING IN RAT** — Times Cited: 29
By: ROSEN, H; BLUMENTHAL, A; MCCALLUM, J
PROCEEDINGS OF THE SOCIETY FOR EXPERIMENTAL BIOLOGY AND MEDICINE Volume: 125 Issue: 1 Pages: 279-+ Published: 1967

24. **In vitro and in vivo wound healing activity of asiaticoside isolated from Centella asiatica** — Times Cited: 205
By: Shukla, A; Rasik, AM; Jain, GK; et al.
JOURNAL OF ETHNOPHARMACOLOGY Volume: 65 Issue: 1 Pages: 1-11 Published: APR 1999

25. **Asiaticoside-induced elevation of antioxidant levels in healing wounds** — Times Cited: 119
By: Shukla, A; Rasik, AM; Dhawan, BN
PHYTOTHERAPY RESEARCH Volume: 13 Issue: 1 Pages: 50-54 Published: FEB 1999

26. **Development of sterculia gum based wound dressings for use in drug delivery** — Times Cited: 63
By: Singh, Baljit; Pal, Lok
EUROPEAN POLYMER JOURNAL Volume: 44 Issue: 10 Pages: 3222-3230 Published: OCT 2008

27. **Wound healing activities of different extracts of Centella asiatica in incision and burn wound models: an experimental animal study** — Times Cited: 56
By: Somboonwong, Juraiporn; Kankaisre, Mattana; Tantisira, Boonyong; et al.
BMC COMPLEMENTARY AND ALTERNATIVE MEDICINE Volume: 12 Article Number: 103 Published: JUL 20 2012

28. **Topical advances in wound care** — Times Cited: 57
By: Stojadinovic, Alexander; Carlson, Jay W.; Schultz, Gregory S.; et al.
GYNECOLOGIC ONCOLOGY Volume: 111 Issue: 2 Supplement: 1 Pages: S70-S80 Published: NOV 2008

29. **DRUG INTERACTION BETWEEN ASIATICOSIDE AND SOME ANTI-INFLAMMATORY DRUGS IN WOUND-HEALING OF RAT** — Times Cited: 9
By: VELASCO, M; ROMERO, E
CURRENT THERAPEUTIC RESEARCH-CLINICAL AND EXPERIMENTAL Volume: 19 Issue: 1 Pages: 121-125 Published: 1976

30. **Wound-healing effect of electrospun gelatin nanofibres containing Centella asiatica extract in a rat model** — Times Cited: 30
By: Yao, Chun-Hsu; Yeh, Jen-Yu; Chen, Yueh-Sheng; et al.
JOURNAL OF TISSUE ENGINEERING AND REGENERATIVE MEDICINE Volume: 11 Issue: 3 Pages: 905-915 Published: MAR 2017

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