



ELSEVIER

Reflections on dermatology: Past, present, and future
Edited by Leonard Hoenig, MD

Charcoal: An ancient material with a new face

Nelson Sanchez, BS*, Rachel Fayne, BA, Brandon Burroway, BS

Dr. Phillip Frost Department of Dermatology and Cutaneous Surgery, University of Miami Miller School of Medicine, Miami, Florida, USA

Abstract Activated charcoal has become popular in the cosmetic industry and is found in a variety of products, including facial cleansers and soaps. For centuries, charcoal has been used as an antidote for poisonings, but now companies claim that charcoal-containing products can treat acne, dandruff, and others; however, clinical evidence does not support these claims. Patients should be counseled that the use of activated charcoal is generally safe but advised that there is a lack of evidence to support its exfoliative or anti-aging abilities.

© 2019 Elsevier Inc. All rights reserved.

History of charcoal use in medicine

The Greek historian Herodotus (484 BCE to ca 425 BCE) provides us with evidence of the first known use of charcoal by mankind, dating back to ancient Egyptian civilizations.¹ It was originally used as a material for cooking and metal making. Medically, charcoal has been used as a dentifrice by a number of civilizations since the time of Hippocrates (450 BCE to 380 BCE) in Ancient Greece.² The first identified medical use of charcoal dates back to 1811, when French chemist Michel Bertrand proved its efficacy by surviving a lethal dose of arsenic trioxide, along with charcoal to block its adsorption.³ Although such an act would not meet today's standards of evidence-based medicine, charcoal is still best known by the modern physician for this same purpose, with extensive evidence to support its clinical efficacy in this capacity. Even animals have demonstrated knowledge of these detoxifying benefits. Scientists from Duke University and the University of Wyoming noted an unusual habit of Zanzibar red colobus monkeys eating charcoal, which they believe is done to counteract the adverse effects of toxic substances in their diet.⁴

* Corresponding author. Tel.: +1 786 402 0298.

E-mail address: nsanchez@med.miami.edu (N. Sanchez).

Current cosmetic use of charcoal

To today's average American, charcoal is best known for whitening teeth and removing skin blemishes. Since around 2014, some of the most influential brands in skin care have promised that charcoal-based products will leave consumers with a smoother, clearer complexion after just one use. Charcoal can be found in facial cleansers, pore strips, carbonated face masks, and soaps and has quickly become one of the most highly advertised ingredients in skin products. Companies and websites claim that charcoal-containing products can treat adult acne, bites or cuts, minor infections, itchy scalp, and seborrheic dermatitis.

Current literature on the uses of charcoal

A Google search reveals hundreds of new products on the market, all emphasizing the natural benefits of charcoal on skin, including skin purification, exfoliation, and even anti-aging (Figure 1); however, a search of PubMed shows only a handful of papers describing current dermatologic uses of charcoal, including dressings to prevent odors from wounds,⁵ reduction of uremic itch,⁶ and dressings to manage skin graft wound

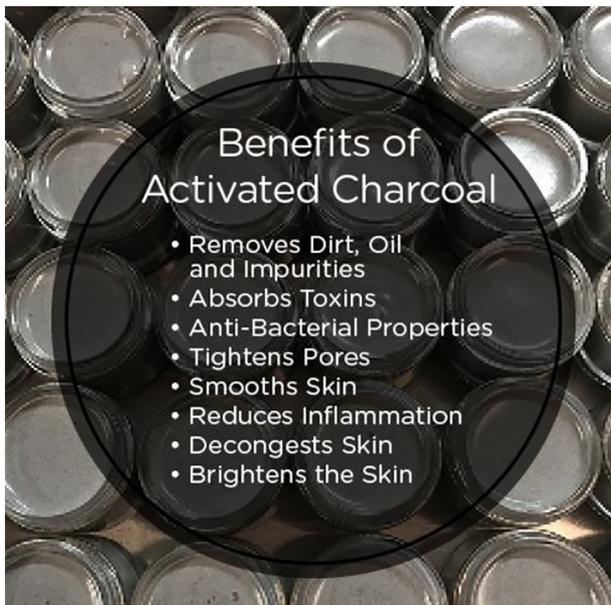


Fig. 1 List of activated charcoal benefits described by a popular beauty website.

infections.⁷ Charcoal's use in wound care can be traced back to 1857 in a book published by British surgeon James Bird (1797-1864), in which he mentioned multiple uses of charcoal among army and navy surgeons of the time. Bird noted charcoal poultice's use in hospital practices "as an application to sloughing ulcers and gangrenous sores, and recently, this substance has afforded immense relief in numerous cases of open cancer, by soothing pain, correcting fetor, and facilitating the separation of the morbid structure from the surrounding parts."⁸ (See Figs. 2 and 3.)

Poultice of Char'coal. *Syn.* CATAPLASMA CARBONIS (B. P., Ph. L.), C. C. LIGNI, L. *Prep.* 1. (Ph. L.) Soak bread, 2 oz., in boiling water, $\frac{1}{2}$ pint; to this add, by degrees, of linseed meal, 10 dr.; and, afterwards, of powdered (recently burnt) charcoal, 2 dr.; lastly, sprinkle on the surface of the poultice powdered charcoal, 1 dr. As an application to fetid and gangrenous sores; frequently renewed.

2. (B. P.) Wood charcoal, $\frac{1}{2}$ oz.; bread, 2 oz.; linseed meal, $1\frac{1}{2}$ oz.; boiling water, 10 oz.; soak the bread in the water near the fire, add the linseed meal and half the charcoal, stirring to a soft poultice, sprinkling the remainder of the charcoal on the surface.

Fig. 2 A snippet from *Cooley's Cyclopædia of Practical Receipts and Collateral Information in the Arts, Manufactures, Professions, and Trades, Including Medicine, Pharmacy, and Domestic Economy: Designed as a Comprehensive Supplement to the Pharmacopœia and General Book of Reference for the Manufacturer, Tradesman, Amateur, and Heads of Families, Volume 2*, by Arnold James Cooley (1880), that lists the ingredients for a charcoal poultice.

How activated charcoal works

Over-the-counter products rely on the basic chemical principles of activated charcoal to support their claims. Activated charcoal is carbon, like coal, but produced from naturally carbon-rich materials such as bamboo, coconut, or wood that has been heated and turned into a powder. This process creates micropores in the carbon, increasing its surface area and increasing its adsorptive properties.⁹ Companies theorize that charcoal's known adsorbent properties trap toxins and chemicals from the skin surface, naturally clearing pores and detoxifying as the charcoal product is rinsed or peeled away. Many of these products also contain known anti-acne and anti-inflammatory ingredients, such as salicylic acid and kaolin, which may explain why some consumers see desired results with their use. Companies may be using the current fad of charcoal to increase sales. Whether due to the charcoal itself, the known anti-acne ingredients, or simply the placebo effect, thousands of online consumer reviews suggest that charcoal-based products have overall positive effects on the skin, including the removal of blackheads, removal of dead skin, and improvement of overall appearance.

Concerns regarding the cosmetic use of charcoal products

Despite the overwhelming number of products touting the beneficial effects of charcoal for the skin, there is insufficient evidence to substantiate the claims made by the companies marketing charcoal-based skin products. With little to no evidence, these corporate claims can be detrimental to patient care by delaying their access to a dermatologist for evidence-based management and treatment of their skin conditions.

In addition, none of these products are FDA approved and are thus unregulated. Despite this, some of these products carry labels such as "tested" and "clinically proven." According to the FDA it is up to the individual companies to ensure product safety, not the FDA. This creates the potential for an unsafe environment of unregulated chemicals being placed in products sold to consumers. Notably the charcoal face masks used to "remove blackheads" have gained the most attention via social media, not only for their efficacy but also due to individuals' reactions to removing the product. This sometimes-painful removal process has led to many dermatologists expressing their concerns over this new fad. Some people and companies are mixing the suspicious foreign charcoal powder with glue, sometimes even super glue. This can cause severe peeling of the skin, which can lead to serious and permanent skin damage, such as scarring and infection. Another area of concern is when a consumer purchases these products from foreign online sources that are outside the jurisdiction and safety of the FDA. Additionally, like any beauty product, it can contain chemicals that can cause allergies or irritation, and there have been reported chemical burns due to unknown

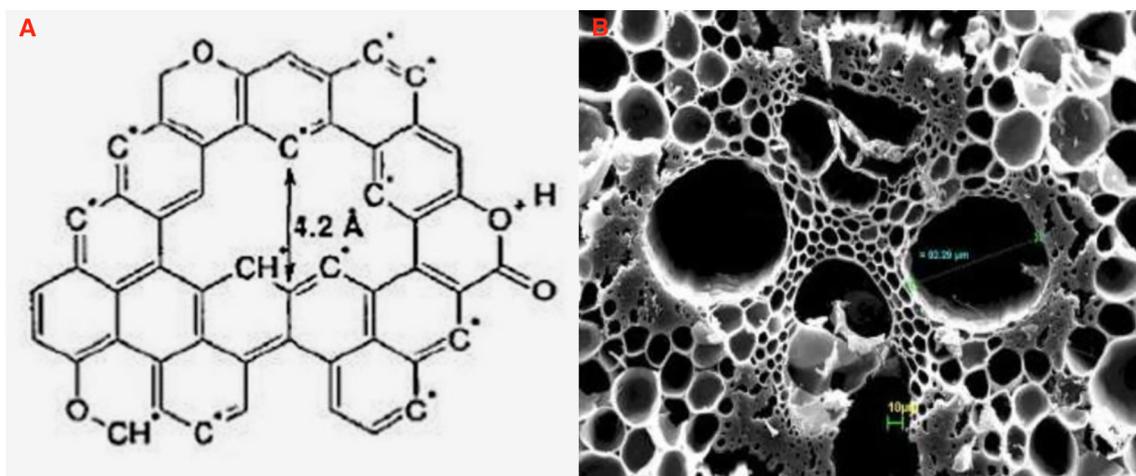


Fig. 3 (A, B). Structure of charcoal. (A) Aromatic structure containing oxygen and carbon free radicals. [Reprinted with permission from Bourke et al (2007)¹¹. Copyright (2019) American Chemical Society.] (B) Electron microscopy showing the porosity of activated charcoal. [<http://ukrfuel.com/news-physical-properties-of-charcoal-22.html>]

substances that have required topical steroids.¹⁰ To minimize the risk of these reactions, it is recommended to check ingredients and purchase the product from a reliable company.

What is the future of charcoal-based cosmetic products?

Charcoal's rapid and rampant growth in popularity should force us to ask the question: Does natural always mean safe? Activated charcoal is generally safe, though it is not recommended for chronic oral intake. Because there have been few studies regarding charcoal's effects on the skin, these products should be used in moderation and with caution. Although there is no concrete evidence that charcoal is an effective treatment for specific skin conditions, it has been used in bandages for wounds with no reported ill-effects and thus is likely overall safe in moderation.⁵ In addition, these products will not break the bank, with most costing less than \$15.

In a time when Instagram can have more influence than a medical professional, time will tell if the charcoal fad will continue or if it will be as fleeting as so many other beauty and skin-care trends before it. It will be interesting to see how dermatologists respond to this trend, and whether evidence-based medicine will support the claims of today's beauty moguls.

Conclusions

Charcoal has been used medicinally for centuries but just recently entered the cosmetic industry as the key to perfect skin; however, there is only anecdotal evidence of whether these products work or not, with no clinical or laboratory evidence. Dermatologists should warn patients that, although

there have been no reported negative effects of charcoal on the skin, there have been equally few reports of its exfoliative or anti-aging abilities.

References

1. Marketos SG, Androutsos G. Charcoal: from antiquity to artificial kidney. *J Nephrol* 2004;17:453-456.
2. Brooks JK, Bashirelahi N, Reynolds MA. Charcoal and charcoal-based dentifrices: a literature review. *J Am Dent Assoc* 2017;148:661-670.
3. Juurlink DN. Activated charcoal for acute overdose: a reappraisal. *Br J Clin Pharmacol* 2016;81:482-487.
4. Zanzibar monkeys eat charcoal to counteract toxins. *ScienceDaily*. Available at: <https://www.sciencedaily.com/releases/1997/09/970901072246.htm> 1997, September 1. Accessed July 24, 2019.
5. Akhmetova A, Saliev T, Allan IU, et al. A comprehensive review of topical odor-controlling treatment options for chronic wounds. *J Wound Ostomy Continence Nurs* 2016;43:598-609.
6. Pederson JA, Matter BJ, Czerwinski AW, et al. Relief of idiopathic generalized pruritus in dialysis patients treated with activated oral charcoal. *Ann Intern Med* 1980;93:446-448.
7. Karonidis A, Delikonstantinou I, Tsoutsos D. Use of Actisorb® dressings over a skin-grafted infected wound. *Burns* 2011;37:360-361.
8. Bird J. *Vegetable Charcoal: Its Medicinal and Economic Properties, with Practical Remarks on Its Use in Chronic Affections of the Stomach and Bowels*. London: John Churchill. 1857.
9. Derlet RW, Albertson TE. Activated charcoal—past, present and future. *West J Med* 1986;145:493-496.
10. Doctors warn of charcoal face mask dangers. Available at: <https://www.wusa9.com/article/news/local/doctors-warn-of-charcoal-face-mask-dangers/65-460532923> 2017. Accessed July 24, 2019.
11. Bourke J, Manley-Harris M, Fushimi C, et al. Do all carbonized charcoals have the same chemical structure? 2. A model of the chemical structure of carbonized charcoal. *Ind Eng Chem Res* 2007;46:5954-5967.