# ALGINATE DRESSINGS – AN OVERVIEW

**Gaurav Solanki*[1], Renu Solanki[2]**

[1]Jodhpur National University, Jodhpur-324003, (Rajasthan) India.
[2]Lachoo Memorial College of Science and Technology, Pharmacy wing, Jodhpur-324003, (Rajasthan) India.

**Corresponding author*:** drgauravsolanki@yahoo.com

This article is available online at www.ssjournals.com

## ABSTRACT

Alginate dressings are highly absorbent, biodegradable material derived from the seaweed. They are used to cleanse wide variety of secreting lesions. They show high absorptivity which is achieved via strong hydrophilic gel formation, this limits the wound secretions, promotes wound healing and also minimizes the bacterial contamination. Alginate dressings are very useful for moderate to heavily exudating wounds. This article throws light on the alginate dressing and its importance medical science. Patents are the richest source of the latest technological information. A review of some patents on alginate dressing is provided that summarizes the recent technical advancements taken place in this area.

**KEY WORDS:** Alginate, Alginate dressing, Uses, Patents

## 1. INTRODUCTION

Alginic acid is an anionic polysaccharide found in the cell walls of brown algae. It is also called as algin or alginate[1, 2]. It has a good water absorbing property i.e. it is capable of absorbing 200-300 times its own weight in water. It is white to yellowish-brown in colour. It is sold in filamentous, granular or powdered forms[3].

## 2. STRUCTURE

Alginates are chain-forming heteropolysaccharides made up of blocks of mannuronic acid and guluronic acid. It is basically a linear copolymer with homopolymeric blocks of (1-4)-linked β-D-mannuronate (M) and its C-5 epimer α-L-guluronate (G) residues, respectively, covalently linked together in different sequences or blocks. These monomers can appear in homopolymeric blocks of consecutive G-residues (G-blocks), consecutive M-residues (M-blocks), alternating M and G-residues (MG-blocks), or randomly as organized blocks[4, 5].

## 3. FORMS

Many varieties of alginate can be extracted out from seaweed- brown algae. Commercially used are *Macrocystis pyrifera, Ascophyllum nodosum* and various types of *Laminaria.* Alginates are also produced by two types of bacterial genera called as *Pseudomonas* and *Azotobacter.*

For medical applications three main forms of alginates are useful. They are sodium alginates, potassium alginates and calcium alginates[6, 7]. The sodium alginate is the sodium salt of alginic acid. Its empirical formula is $NaC_6H_7O_6$ while potassium

alginate is the potassium salt of alginic acid. Its empirical chemical formula is $KC_6H_7O_6$. The calcium alginate is the calcium salt of alginic acid. Its empirical formula is $CaC_6H_7O_6$. Generally calcium alginates dressing are used in hospitals because it has strong absorptive capacity, absorb lots of exudate quickly, provide lock-in facility on microorganism for infected wounds, forms a gel which creates an ideal moist environment for stimulating wound healing, does not stick on the wound, reduces pain, can be easily peeled off from the skin, enhance the growth of the cavity. Calcium alginate dressing also releases calcium ion which activates prothrombin, and thus accelerates the cruor.

## 4. WORKING OF ALGINATE DRESSINGS

When the alginate dressing are placed on the infected wound area then the exudate and the blood are absorbed, simultaneously it forms a gel that protect the surface of wounds and helps in the healing of the wound[8, 9].

## 5. USES

Alginates are used in the forms of pads, ropes or ribbons. They are useful in a variety of wound situations like in epithelizing wounds, moist sloughy wounds, shallow heavily exuding wounds, cavity wounds. Because of its strong absorptivity it limits wound secretions and minimizes bacterial contamination.

Alginic acid (alginato) is also used in culinary arts, most notably in the Esferificación where natural juices of fruits and vegetables are encapsulated in bubbles that explode on the tongue when consumed like the use of Alginic acid to make apple caviar[10].

It is also useful as an additive in dehydrated products such as slimming aids and in the manufacture of paper and textiles. It is also used for waterproofing and fireproofing fabrics, as a gelling agent and for thickening drinks, ice cream and cosmetics.

Alginate is used in various pharmaceutical preparations also such as Gaviscon, Bisodol and Asilone. Alginate is used as an impression-making material in dentistry, prosthetics, life casting. It is also used in the food industry for thickening soups and jellies[11].

Calcium alginate is used in different types of medical products like in preparing burn dressings that promote healing and can be removed with less pain than conventional dressings. As alginate is biocompatible and has a simple gelation with divalent cations such as $Ca^{2+}$, it is widely used for cell immobilization and encapsulation [12].

Due to its ability to absorb water quickly, alginate can be changed through a lyophilization process to a new structure that has the ability to expand. Thus it is also used in the weight loss industry as an appetite suppressant.

Sodium alginate as a flavorless gum is used by the foods industry to increase the viscosity and as an emulsifier. It is also used in indigestion tablets and the preparation of dental impressions. Potassium alginate is widely used in foods as a stabilizer, thickener, and emulsifier [13].

Some other uses shows that such type of alginates can be used in all kinds of infected moderate, heavily exuding wounds, chronic wounds, bleeding wounds, in all kinds of lacuna, antrum wounds, such as nasal cavity, anus and intestines.

## 6. ADVANTAGES[14, 15]

They do not physically inhibit wound contraction as would gauze, requires less care than other dressings, fills dead space, conforms to wound shape, are designed to be occlusive and can absorb large exudates (up to 20 times its own weight), maintains moist wound interface, leaves fewer residues thus reduces the need for irrigation that might damage new tissue, uniformly absorbs the exudate, protects the peri-wound skin and also helps in avoiding lateral wicking.

## 7. DISADVANTAGES[16, 17]

They require a secondary dressing; can be too drying if wound has a low volume of exudate, cannot be used in non-exudative, dry wounds, in sinus tracts, shows risk of dehydrating wound bed and delaying wound healing (risk of scab formation).

## 8. SIDE EFFECTS

There has been one report of a florid foreign body giant cell reaction seven months after the use of an alginate dressing to obtain haemostasis in an apicoectomy cavity on an upper lateral incisor. The case suggested that alginate fibers left in situ may elicit a long-lasting and symptomatic adverse foreign body reaction. It is suggested that alginates should be reserved for problematic haemorrhage and should be removed from the tooth socket soon after haemostasis. To date, this is the only published reported side effect concerning foreign body reaction to alginate[18, 19, 20].

## 9. SOME PATENTS ON ALGINATE DRESSINGS

### 9.1 Alginate fibrous dressing and method of making the same

The method disclosed, an alginate fibrous dressing comprising of a fibrous alginate layer needle punched to a non-alginate backing web such that fibers from the alginate layer penetrate into the infected area and is interlocked with the backing web thereby affixing the alginate layer to the backing web. This dressing showed improved absorbency and long-term stability when used in the treatment of wounds. It also eliminates the need for adhesives and secondary dressings for retaining an alginate fibrous dressing on a wound site[21].

### 9.2 Process for preparing the alginate-containing wound dressing

The process disclosed, the preparation of wound dressing comprising of an absorbent pad impregnated with an alginate. It promotes wound healing by exhibiting haemostatic properties when it comes in contact with the wounded cell[22].

### 9.3 Alginate gel based adsorbents for heavy metal removal

According to the present invention, an alginate gel adsorbent is used to remove heavy metal ions. It is prepared by adding drop wisely 0.1-5 wt % alginate solution to the polyvalent cationic solution, thereby cross-linking alginic acid with polyvalent cations. The gel adsorbent contains activated carbon which is capable of simultaneously removing heavy metal ions and organotoxic materials. The polyvalent cationic solution consisting of calcium chloride ($CaCl_2$), strontium chloride ($SrCl_2$), barium chloride ($BaCl_2$) and aluminium chloride ($AlCl_3$). This alginate gel adsorbent is useful in water purification[23].

### 9.4 Monolithic in-situ cross-linked alginate implants

The method disclosed the making and using of a monolithic alginate implant. The implant is prepared by providing an uncrosslinked, highly pure and high molecular weight alginate solution. Spontaneous cross linking of the monolithic alginate implant occurs at the predetermined site without the addition of an exogenous cross linker. The implant may be used for treating medical conditions requiring support of sphincter musculature, reconstructive surgery, or cosmetic reconstruction, for the treatment of wrinkles on the hand, face or for increasing volume, for example in the case of (HIV-induced) lipoatrophy of the breasts, for the treatment of diseases like gastro esophageal reflux disease, urinary incontinence or vesicoureteral reflux disease etc[24].

### 9.5 Alginate foam products

The method disclosed the composition of alginate foam product. It comprises of sodium alginate, frozen and lyophilized into an alginate foam product. It has utility in wound management as a dressing[25].

## 10. CONCLUSION

As alginate dressing show high absorptivity so it is used to cleanse wide variety of secreting lesions. They promote wound healing and also minimize the bacterial contamination. They require less care as compared to other dressings and also fill dead spaces. This article also depicts some useful patents on alginate. Hope this review will be helpful in providing some useful information related to alginate dressing to medical students.

## REFERENCES


1. http://www.ncl.ac.uk/press.office/press.release/item/seaweed-to-tackle-rising-tide-of-obesity.
2. Gilchrist T, Martin AM. Wound treatment with sorbsan-An alginate fiber dressing; Biomaterials; 1983. 4 (4):317-20.
3. Roew R. Adipic Acid: Handbook of Pharmaceutical Excipients; 8th ed. Saunders; 2008. p. 382-92.
4. Remminghorst and Rehm. Microbial Production of alginate: Biosynthesis and applications. Microbial production of biopolymers and polymer precursors. Caister Academic Press; 2009. ISBN 978-1-904455-36-3.
5. Calcium alginate topical wound dressings: A new dimension in the cost-effective treatment for exudating dermal wounds and pressure sores; Ostomy Wound Manage; 1989.p. 52-56.
6. Doyle JW, Roth TP, Smith RM. Effects of calcium alginate on cellular wound healing processes modeled in vitro. J Biomed Mater Res; 1996. 32 (4): 561-68.
7. Odell EW, Oades P, Lombardi T. Symptomatic foreign body reaction to haemostatic alginate; Br J Oral Maxillofacial Surg; 1994. 32 (3):178-79.
8. http://www.worldwidewounds.com/1997/july/Thomas-Guide/Dress-Select.html.
9. Sayag J, Meaume S, Bohbot S. Healing properties of calcium alginate dressings; J Wound Care; 1996. 5 (8): 357-62.
10. http://starchefs.com/events/lo_mejor_de_la_gastronomia/2003/html/apple_caviar_f_adria.shtml.
11. Segal HC, Hunt BJ, Gilding K. The effects of alginate and non-alginate wound dressings on blood coagulation

and platelet activation. J Biomater; 1998. 12 (3): 249-57.

**12.** Sutton A, Harrison GE, Carr TE, and Barltrop D. Reduction in the absorption of dietary strontium in children by an alginate derivative. Br.J.Radiol; 1971. 44 (23): 567-69.

**13.** Torres G, Galindo CA, Torra JE. Pure calcium-sodium alginate dressing. Multicenter evaluation of chronic cutaneous lesions. Rev Enferm; 1997. 20 (29):23-30.

**14.** Berry DP, Bale S, Harding KG. Dressings for treating cavity wounds; J Wound Care; 1996. 5 (1): 10-17.

**15.** Thomas S. A structured approach to the selection of dressings. World Wide Wounds; 1997.

**16.** Galindo CA, Thomas S. Four alginate dressings in the treatment of partial thickness wounds: A comparative experimental study; Br J Plast Surg; 1996. 49 (2): 129-34.

**17.** Henderson NJ, Crawford PJ, Reeves BC. A randomized trial of calcium alginate swabs to control blood loss in 3-5-year-old children. Br Dent J; 1998. 184 (4):187-90.

**18.** http://www.alginate.com.

**19.** Donoghue JM, Sullivan ST, Beausang ES. Calcium alginate dressings promote healing of split skin graft donor sites. Acta Chir Plast; 1997. 39 (2): 53-55.

**20.** Scherr GH. Alginates and alginate fibers in wound healing. A compendium of clinical research and practice, Health Management Publications, Inc; 1992.

**21.** Scherr H, George H in-ventors; Alginate fibrous dressing and method of making the same. DeRoyal Industries Inc. (Powell, TN). US patent 5,674,524; 1997 Oct 07.

**22.** Patel A, Harish A in-ventors: Process for preparing the alginate-containing wound dressing. The Kendall Co., Ltd. (Mansfield, MA). US patent 5,470,576; 1995 Nov 28.

**23.** Hyun GP, Kyung HK, Chae EG, Lee EY in-ventors. Alginate gel based adsorbents for heavy metal removal. Samsung General Chemicals Co., Ltd. US patent 6,989,102; 2006 Jan 24.

**24.** Beausang ES, Chae EG, Lee EY in-ventors. Monolithic in-situ cross-linked alginate implants. US patent 6,097,367; 2010 Apr 28.

**25.** George H, Scherr in-ventors. Alginate foam products. US patent 5,718,916;1998Feb17.