Appendix A

Materials of formulations in this study

1. Hydrogenated vegetable oil

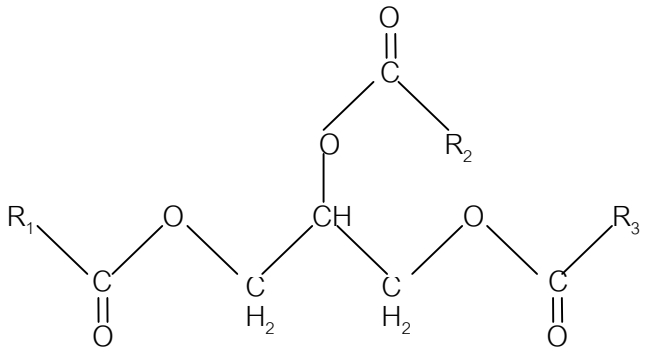

Figure 13. Structural formula of hydrogenated vegetable oil, type I

Hydrogenated vegetable oil is a mixture of triglycerides of fatty acids. The two types which are defined in the USPNF XVII (Suppl 5) are characterized by their physical properties.

Hydrogenated vegetable oil, type I occurs in various forms, e.g. fine powder, flakes or pellets. The color of the material depends on the manufacturing process and the form. In general, the material is white to yellowish-white with the powder grades appearing more white-colored than the coarser grades.

Hydrogenated vegetable oil, type I is additionally used as the matrix forming material in lipophilic based controlled release formulations; it may also be used as a coating aid in controlled release formulations (Wade and Weller, 1994).

Hydrogenated vegetable oil is used in formulation of biocontrol agent (Kanjanamaneesathian *et al.*, 1998; Kusonwiriyawong *et al.*, 1999; Pengnoo *et al.*,

2000; Wiwattanapatapee *et al*., 2004). It provided floatability so the formulation containing hydrogenated vegetable oil can float.

2. Hydroxyethyl cellulose

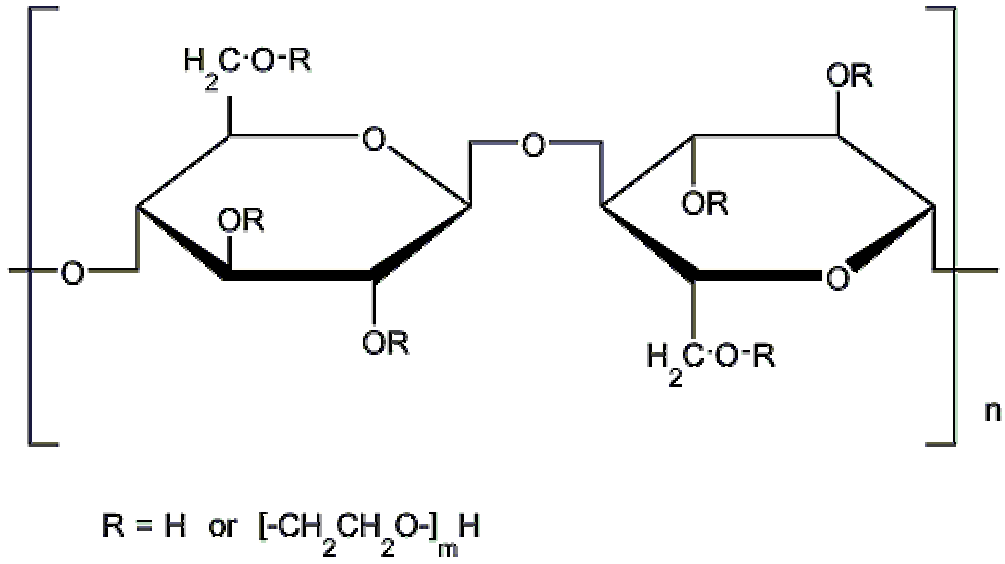

Figure 14. Structural formula of hydroxyethyl cellulose

Hydroxyethyl cellulose occurs as a light tan or cream to white colored, odorless and tasteless, hygroscopic powder.

Hydroxyethyl cellulose is a nonionic, water soluble polymer widely used in pharmaceutical formulations. It is primarily used as a thickening agent in ophthalmic and topical formulations although it is also used as a binder and film-coating agent for tablets (Wade and Weller, 1994).

In this study, it was used as a gelling agent in granule formulation for spray application.

3. Hydroxypropyl methylcellulose

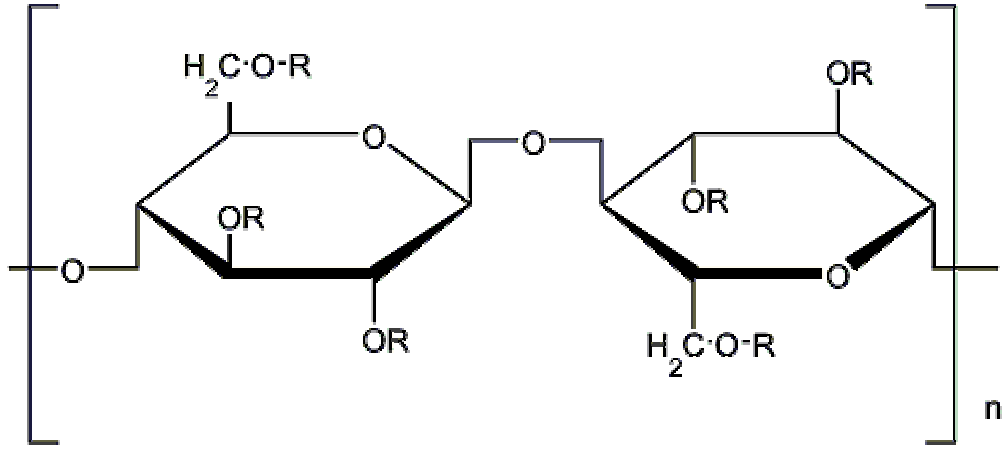

Figure 15. Structural formula of hydroxypropyl methylcellulose

Hydroxypropyl methylcellulose is an odorless and tasteless, white or creamy-white colored fibrous or granular powder. It dissolves slowly in cold water and solutes in most polar organics. It is not soluble in hot water. It has thermogelling properties and higher salt tolerance. It is more soluble than methylcellulose. It is also used as a suspending, thickening agent and a sticker for agricultural sprays (Wade and Weller, 1994; Budavari, 1996).

In this study, it was used as a gelling agent in granule formulation for spray application.

4. Lactose monohydrate

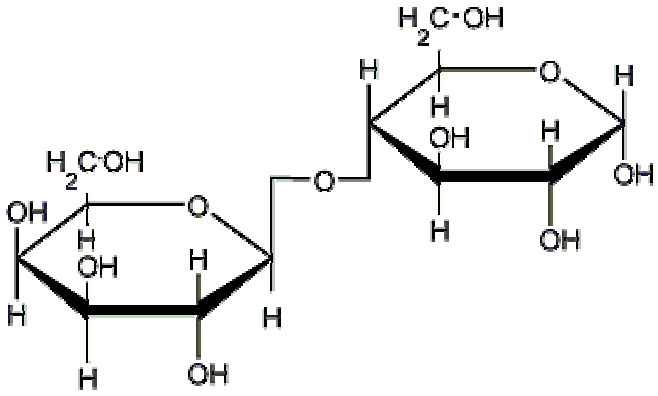

Figure 16. Structural formula of α-lactose monohydrate

Lactose (Milk sugar, Pharmatose) is white to off white crystalline particles or powder. It is odorless and slightly sweet tasting. It is widely used as a filler or diluent in tablets, capsules, and to a more limited extent in lyophilized products and infant feed formulas (Wade and Weller, 1994; Budavari, 1996).

α-Lactose monohydrate, is the usual milk sugar and the lactose of pharmacy. It is monoclinic sphenoidal crystals from water and faintly sweet taste. It is stable in air but readily absorbs odors.

Lactose is used as a filler or diluent in formulation of biocontrol agent (Kanjanamaneesathian *et al*., 1998; Kusonwiriyawong *et al*., 1999; Pengnoo *et al*., 2000; Wiwattanapatapee *et al*., 2004). Carrier or filler should be inert ingredient (Fravel *et al*., 1998). Because lactose has inert property, it is suitable for being carrier or filler. In this study, lactose was filler in all formulations because it is soluble, available, cheap and inert ingredient.

5. Magnesium stearate

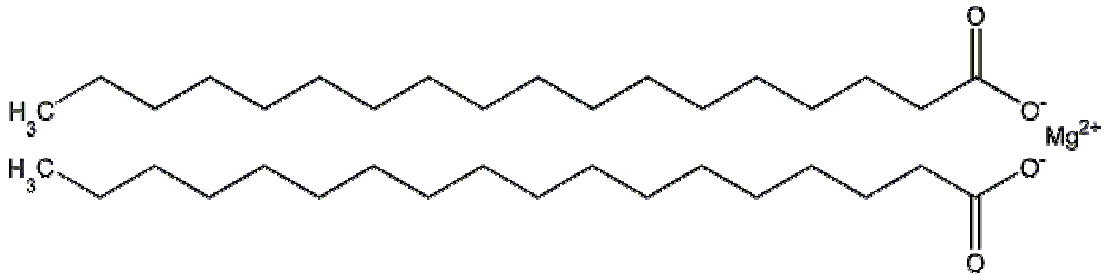

Figure 17. Structural formula of magnesium stearate

Magnesium stearate is a fine, white, precipitated or milled, impalpable powder of low bulk density, having a faint, characteristic odor and taste. The powder is greasy to the touch and readily adheres to the skin. It is primarily used as a lubricant in capsule and tablet manufacture at concentrations between 0.25 - 5.0% (Wade and Weller, 1994; Budavari, 1996).

In this study, magnesium stearate was used as a lubricant in tablet formulation for spray application.

6. Methylcellulose

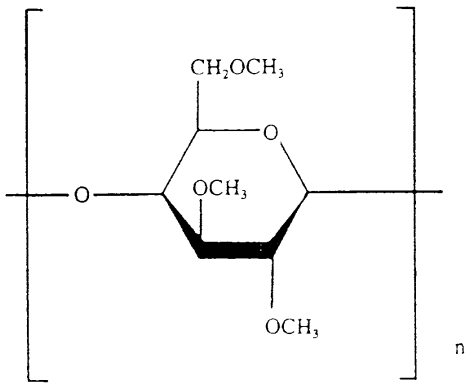

Figure 18. Structural formula of methylcellulose

Methylcellulose occurs as practically odorless and tasteless, white to yellowish-white colored granules or as a powder. It is soluble in cold water. An aqueous solution is best prepared by dispersing the granules in hot (but not boiling) water with stirring and chilling to 5°C. The solution is then stable at room temperature (Wade and Weller, 1994; Budavari, 1996).

In this study, it was used as a gelling agent in granule formulation for spray application.

7. Sodium alginate

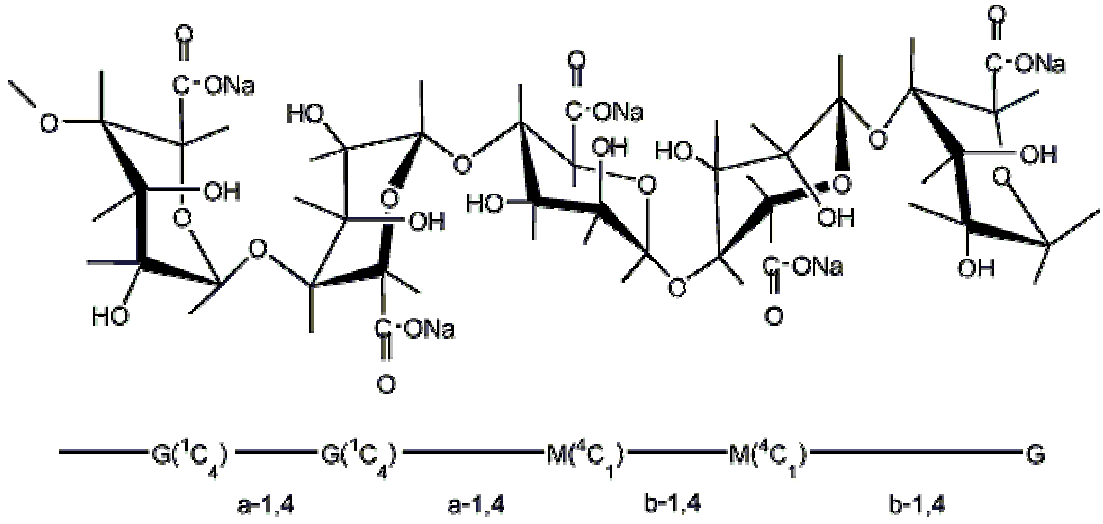

Figure 19. Structural formula of sodium alginate

Sodium alginate occurs as an odorless and tasteless, white to pale yellowish-brown colored powder.

It is used in a variety of oral and topical pharmaceutical formulations. In tablet formulations, it may be used as both binder and disintegrant. It has also been used in the preparation of sustained release oral formulations since it can delay the dissolution of a drug from tablets and aqueous suspensions.

In topical formulations, sodium alginate is widely used as a thickening and suspending agent in a variety of pastes, creams and gels, and as a stabilizing agent for oil-in-water emulsions (Wade and Weller, 1994; Budavari, 1996).

Sodium alginate is used in formulation of biocontrol agent (Fravel *et al.*, 1998). In this study, it was used as a gelling agent in granule formulation for

spray application and as a binder in granule and tablet formulations for broadcast application.

8. Sodium Carboxymethylcellulose

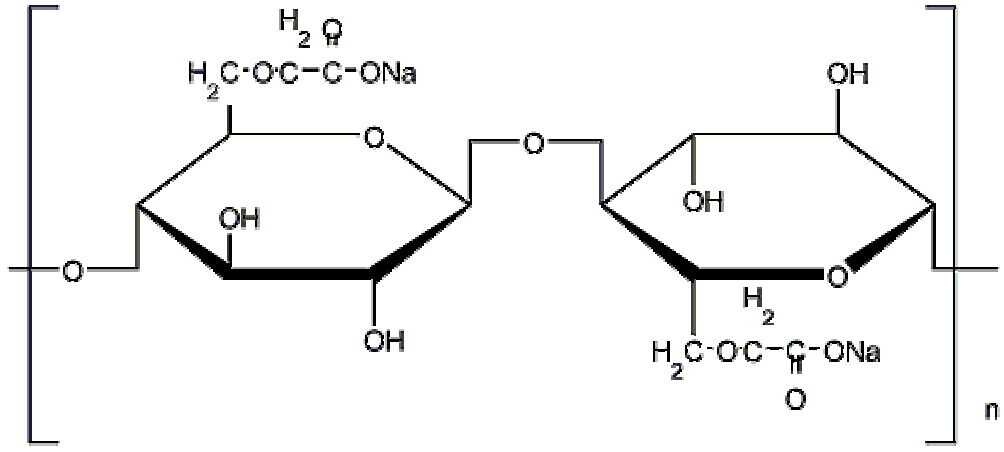

Figure 20. Structural formula of sodium carboxymethylcellulose

Carboxymethylcellulose sodium occurs as a white to almost white colored, odorless, granular powder. Water soluble CMC is available in various viscosities (5-2000 cps in 1% solution) and it is soluble in hot and cold water (difference from methylcellulose). It is widely used in oral and topical pharmaceutical formulations primarily for its viscosity-increasing properties. It may also be used as a tablet binder and disintegrant, and to stabilize emulsions (Wade and Weller, 1994; Budavari, 1996).

In this study, it was used as a gelling agent in granule formulation for spray application and as a binder in tablet formulations for spray application.

9. Sodium starch glycolate (Explotab®)

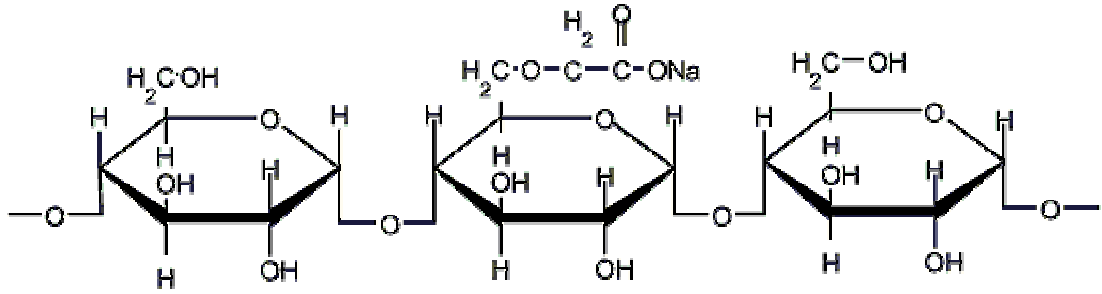

Figure 21. Structural formula of sodium starch glycolate

Sodium starch glycolate is a white to off-white, odorless, tasteless, free-flowing powder. It consists of oval or spherical granules, 30-100 μm in diameter with some less-spherical granules ranging from 10-35 μm in diameter.

Sodium starch glycolate is widely used in oral pharmaceuticals as a disintegrant in capsule and tablet formulations. It is commonly used in tablets prepared by either direct compression or wet granulation processes. The usual concentration employed in a formulation is between 2-8%, with the optimum concentration about 4% although in many cases 2% is sufficient. Disintegration occurs by rapid uptake of water followed by rapid and enormous swelling (Wade and Weller, 1994).

In this study, it was used as a disintegrant in tablet formulation for spray application.

10. Talcum (Talc)

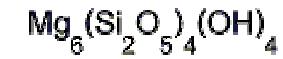

Figure 22. Structural formula of talcum

Talc is a very fine, white to grayish-white colored, odorless, impalpable, unctuous, crystalline powder. It adheres readily to the skin, is soft to the touch, and free from grittiness. It is not soluble in water, cold acids or alkalies.

Talc is widely used in oral solid dosage formulations as a lubricant and diluent. It is also used in topical preparations as a dusting powder, although it should not be used to dust surgical gloves. Since talc is a natural material it may frequently contain microorganisms and should therefore be sterilized when used as a dusting powder (Wade and Weller, 1994; Budavari, 1996).

Talcum is used as a filler or diluent in formulation of biocontrol agent (Vidhyasekaran and Muthamilan,1995; Fravel *et al.*, 1998; Nandakumar *et al.*, 2001 and Radja Commare *et al.*, 2002). In this study, talcum was used as a lubricant in tablet formulation for spray application.

Appendix B

1. Potato dextrose agar (PDA)

Potato	200	g
Dextrose	20	g
Agar	17	g
Distilled water	1000	ml

2. Potato dextrose broth (PDB)

Potato	200	g
Dextrose	20	g
Distilled water	1000	ml

3. Plate Count Agar (Difco®)

Bacto Tryptone	5.0	g
Bacto Yeast Extract	2.5	g
Bacto Dextrose (Glucose)	1.0	g
Bacto Agar	15.0	g
Distilled water	1000	ml