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## REVIEW ARTICLE

**WOUND HEALING POTENTIAL OF MEDICINAL PLANTS WITH THEIR SCREENING MODELS: A COMPREHENSIVE REVIEW**

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\*Corresponding Author's Email id: [sukhbirtips@gmail.com](mailto:sukhbirtips@gmail.com)**ABSTRACT:**

A wound is a breakage in tissue continuity that can be produced by physical, chemical and thermal damage. It is a generally called as physical injury that cause opening and breaking of skin. Healing of chronic cutaneous wound is a big problem and it involves the restoration of continuity after wounding. Wounds are treated with various medicinal herbs or their extracts. Plants provide various remedies to mankind and herbal plants are nature's gift used to treat wound with much lesser side effects. Some of those plants are *Acalypha langiana*, *Tinospora cardifolia*, *Tragia involucrata*, *Napoleona Imperialis*, *Prosopis cineria*, *Lawsonia alba*, *Ginkgo biloba*, *Aloe vera*, *Catharanthus roseus*. This review discusses about the wound healing potential of herbal plants and provides overview on wound healing problems and solution.

**Key words:** wound healing, herbal remedies, open wound, close wound, models.

**INTRODUCTION**

A wound is a breakage in the tissue continuity, from violence and trauma<sup>1</sup>. It can be produced by physical, thermal, chemical or immunological damage to the tissue<sup>2</sup>. They do not only affect the physical and mental health of patients but also impose the significant cost on them<sup>3</sup>. Wound generally termed as physical injury that cause opening and breaking of skin<sup>4</sup>. A wound consist of physical damage (pressure ulcers), thermal damage (burns), mechanical damager (cut, abrasion, lacerations) etc.

**Wound Types:**

Normally wounds are classified into three classes i.e. based on nature of wound, intensity of the wound and physiology of the wound.

**Based upon nature wound**

**Open wound:** An open wound is break in skin's surface that may cause external bleeding and allow bacteria to enter in the body, causing an infection such as: contusions, abrasions, hematoma<sup>5</sup>, incision, laceration, abrasion etc.<sup>6</sup>.

**Closed wounds:** When blunt object strikes the body, a closed wound happens such as: incised, lacerated, penetrating & crushed.

**Based upon intensity of wound<sup>7</sup>**

**Simple wound:** In this type, the damage is only to the skin.

**Complex wound:** In this type, the wound involves underlying tissues, tendons etc.

**Based upon physiology of wounding**

**Acute wounds:** Those wounds that get healed in short period of time and proceeds through series of steps that are necessary for wound healing for the restoration of anatomical integrity of injured site, such as: wound due to cut & surgical injury<sup>8</sup>.

**Chronic wounds:** These types of wounds takes a long period of time for their healing. For example: local infection, loss of oxygen supply, trauma, diseases such as diabetes, nutritional insufficiency and medication may contribute to development of chronic wounds<sup>9</sup>.

**Wound repair involves two steps**

1. Regenerating injured tissues by parenchymal cells. It involves cell migration & cell multiplication.
2. Replacement & wound contraction of connective tissue.

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**Wound Healing:** Wound healing involves the restoration of continuity after wounding & act as a survival mechanism to maintain normal status of living tissue<sup>10</sup>. Wound healing is a process of cell contraction,

movement, re-adhesion after injury. Wound healing is the first stage of series of cellular events which are necessary to initiate a regenerative response<sup>11</sup>.

**Wound healing is possible by two ways<sup>6</sup>:**

<p><b>Primary healing</b>                  Closure of wound within hours after its creation                  Duration of healing is short                  During primary healing, wounds get infected</p>	<p><b>Secondary healing</b>                  Closure of wound by contraction and epithelialization                  Duration of healing is long                  During secondary healing, wound may be or may not be infected.</p>
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**NORMAL WOUND-HEALING PROCESS<sup>12,13</sup>**

**Hemostasis:**

Hemostasis starts immediately after injury and cause arrest of bleeding by formation of platelets. It involves vascular constriction, Platelet aggregation & fibrin formation (Table no.1).

**Inflammation:**

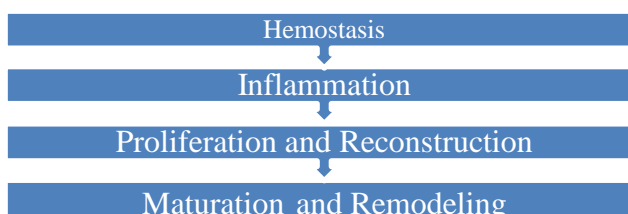
It lasts for 4-6 days. It involves hemostatic mechanism to prevent blood loss from the site of wound<sup>14</sup>.

**Proliferation:**

It starts after inflammation which lasts for 5-21 days. It involves the formation of granulation tissue, angiogenesis, re-epithelialization.

**Remodeling:**

This phase lasts for 3 weeks -2 years. It involves the synthesis of collagen and scar formation<sup>15</sup>(Flow chart1).



**Flow chart 1: Phases of Wound Healing**

**Table 1: Phases of Wound Healing**

Sr. no.	Phase of healing	Time post injury	Cells involved in phases	Function or purpose
1.	Hemostasis	Immediate	Platelets	Arrest of bleeding
2.	Inflammation	2-5 days	Neutrophils Macrophages	Removal of cell debris and infection causing agents
3.	Proliferation (granulation and contraction)	5-3 weeks	Lymphocytes Fibroblasts Keratinocytes	Granulation tissue formation, angiogenesis
4.	Remodeling (maturation)	21 days -2years	Fibroblasts	Formation of collagen & maturation of scars

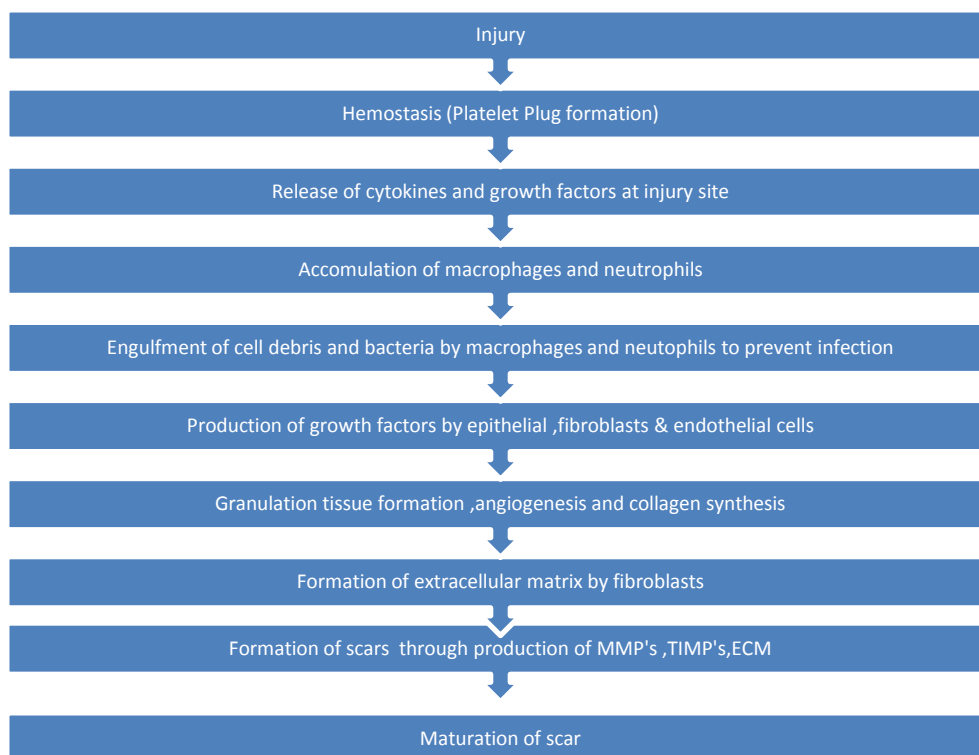
**PHYSIOLOGY OF WOUND HEALING:**

Wound healing process consist of mainly four phases i.e. hemostasis ,inflammation, proliferation and remodelling. After the injury ,hemostasis starts immediately that is followed by inflammation. It involves the bloodvessels constriction, movements of platelets towards the injured site, coagulation of blood through the release of various factors such as platelet - derived growth factor (PDGF's) and transforming other growth factor beta (TGF- β) and other chemoattractant factors that are released by injured parenchymal cells. Inflammation is then followed by proliferative phase. It promotes the replication of cells such as mesenchymal

cells ,fibrocytes ,endothelial cells and platelets that are required for regeneration of tissues and regrowth of capillaries by angiogenesis (formation of new blood vessels by construction of endothelial cells)<sup>16</sup> to enhance the blood supply to the injured cells. During this phase, the repair processes are angiogenesis, fibroplasia & epithelisation.The final stage of wound healing is maturation & remodelling phase leading to maturation & formation of scar through production of MMM's(matrix metallo peotinases),TIMP's and ECM (extracellular matrix)( **Table No. 2**). The wound contraction is promoted by myofibroblasts and combination of all these steps results in the healing of wound with formation of scar<sup>17</sup> (**Flow chart 2**).

**Table 2: Blood components involved in wound healing:**

Sr.no.	Components	Time of appearance	Effect
1.	Fibronectin	Immediately after injury	Structural support for cell migration organisation of collagen.
2.	Neutrophils	6 hours after injury	Wound debridement
3.	Platelet	Immediately after injury	Hemostasis; release growth factors; releases proteolytic enzymes.
4.	Macrophages	3-5 hours after injury	Wound debridement; release growth factors.
5.	Fibroblasts	48-72 hours after injury	Synthesis of collagen,proteoglycans ;wound maturation & contraction.
6.	Keratinocytes	After injury, first 24 hours	Epidermal secondary healing to migration & mitosis; formation of fibronectin.
7.	Collagen	Several days & weeks, later after injury.	Structural support and strength regulate cellular interactions.
8.	Proteoglycans	2 weeks after injury	Regulation of collagen synthesis and cellular interactions.
9.	Hyaluronic acid	4 days after injury	Increase cell motility.



**Flow chart 2: Physiology of wound healing<sup>18</sup>**

**FACTORS AFFECTING WOUND HEALING<sup>19</sup>:**

**Local Factors:** Movement, topical agents, foreign bodies, vascular surgery, type size & location, infection.

**Systemic Factors:** Circulatory conditions, Hormones, Malnutrition, Immunosuppressions, Systemic Infections, Metabolic changes.

**Table 3: Signs and symptoms of wound healing:<sup>20</sup>**

Systemic Infection	Deep wound infection	Superficial increased bacterial burden
Fever	Bigger size	Non healing
Chills	Decreased temperature	Exudate wound
Increased blood pressure	New breakdown areas	Red and bleeding wound
Multiple organ failure	Exudate, Erythema & Oedema	Debris in the wound
	Smell from wound	Smell from wound

### TREATMENT AVAILABLE FOR WOUND HEALING:

**Honey:** Honey is used as an effective remedy for wounds, burns, ulcers (leg ulcers, pressure ulcers, diabetic foot ulcers). It is a saturated and supersaturated solution of sugars that have strong interaction with water molecules. In this case, when honey is diluted by wound exudates, hydrogen peroxide produced by an enzyme i.e. glucose oxidase which released slowly & provide protection from bacteria.

**Home Treatment for Minor Wounds:** Minor wounds have been treated at home.

Wash and disinfect the wound to remove all the dirt and debris.

Then use direct pressure and elevation to control the bleeding and swelling.

During wound wrapping, always use sterile dressing or bandage.

During pain, Acetaminophen can be taken.

Apply ice during burns and avoid picking at scabs.

#### Treatment of wound infection:

- **Wound cleaning:** It may be done with soap and water to wash the germs and also decrease the risk for infection. The wound may be washed with sterile water and germ killing solution is used. Dirt from the wound will be removed by debridement (surgical cleaning). After that wet bandages may be placed inside the wound and left to dry. Then drain the wound to clean out pus.
- **An antibiotic helps** to prevent an infection caused by bacteria eg. cephalexin

#### Complications of wound healing <sup>21</sup>

**a. Deficient scar formation:** Due to inadequate granulation tissue formation or unsuitable extracellular matrix leads to deficient scar formation.

**b. Ulceration:** Due to inadequate blood supply or vascularization.

**c. Excessive scar formation:** Due to excessive deposition of extracellular matrix at the site of wound.

**Table 4: Ethanobotanical claims for the herbs having wound healing activity**

S. N.	Name of Plant	Family	Scientific name	Vernacular Name	Part used	Chemical Constituents	Uses	Ref
1.	<i>Acalypha langiana</i>	Euphorbiaceae	Ricinocarpus langianus	Indian acalypha	Fresh leaves	acalyphine and triacetoneamine and include cyanogenic, glucosides and alkaloids	Wound healing	22
2.	<i>Aloe vera</i>	Aloaceae	Aloe Barbadensis miller	Gheekumari	Leaves, latex	aloe-emodin, barbaloin.	Wound healing	23 24
3.	<i>Alternanthera sessilis</i>	Amaranthaceae	Alternanthera sessilis L.	chanchi, haicha	Leaves	stigmasterol, campesterol, B-sitosterol, a-stigmastanol and also contain 5-a-stigmasta-7-enol.	Antibacterial, wound healing	25
4.	<i>Artemisia pallens</i>	Asteraceae	Artemisia pallens	Davana, Davanum, Artemisia pallens herb oil	Whole plant	Davanone, davan ether, davana, furanand linalool.	Cuts and wounds	26
5.	<i>Azadirachta indica</i>	Meliaceae	Azadirachta indica	Margosa, Neem	Whole plant	nimbin, azadiradione, deacetylnimbin.	Diabetes, Antibacterial	27, 28
6.	<i>Catharanthus roseus</i>	Apocynaceae	Catharanthus roseus(L.)	cayenne jasmine, old maid, sada bahar, sada bahar	Flowers	Rosinidin, Vincristine.	Antidiabetic, Antitumor	29
7.	<i>Clerodendron serratum</i>	Verbenaceae	clerodendrum serratum (linn.)	Blue glory, Beetle killer	Roots, Leaves	carbohydrates, flavanoids, phenolics, terpenoids and steroids.	Asthma, wounds	30
8.	<i>Cynodon dactylon</i>	Poaceae	Cynodon dactylon (L.)	Bermuda grass	Grass	Proteins, carbohydrates, calcium, sodium and others includes cartone palmitic acid, triterpenoids, ergonovine, ergonovinine.	Anticonvulsant	31 32
9.	<i>Elephantopus scaber</i>	Asteraceae	Elephantopus scaber L.	Gojialata, Shamdalan	Whole plant	sesquiterpene lactones, triterpenoids, steroids, flavanoids.	Eczema, wounds, ulcers	33, 34
10.	<i>Euphorbia</i>	Euphorbiaceae	Snake weed	dudhani,	Aerial	heptacosane,	Cuts,	35,

	<i>hirta</i>			dudhi.	parts	leucocyanidin, camphol, shikmic acid, tinyatoxin, choline, camphol, quercitol derivatives containing rhamnose and chtolphenolic acid.	wounds, boils, burns	36
11.	<i>Ginkgo biloba</i>	Ginkgoaceae	Ginkgo biloba	Balkuwari	Leaf	terpene, trilactones i.e.ginkgolides, alkylphenols,6-hydroxykynurenic acid, polyprenol.	brain disorders, bronchitis	37
12.	<i>Jatropha curcas</i>	Euphorbiaceae	jatropha curcas	parvataranda, jangalirandi, ratanjot	Leaf	flavanoids, alkaloids, saponins, tannins, triterpenoids.	Paralysis, skin diseases	38, 39
13.	<i>Kaempferia galanga</i>	Zingiberaceae	Kaempferia galangal linn.	chandramul, chandramulika	Rhizomes	ethyl cinnamate (25%), ethyl-p-methoxy cinnamate (30%), p-methoxy cinnamate,3-carene-5-one.	Wounds Lycopodium	40
14.	<i>Lycopodium serratum</i>	Lycopodiaceae	lycopodium clavatum Linn.	licopodio clavato (Italian)	Leaf	fixed oil (47%), serratene triterpenoids ,lycopodine, clavatine, clavatoxine, flavanoids including apigenin and triterpenes.	Wounds	41
15.	<i>Lawsonia alba</i>	Lythraceae	lawsonia alba lam.	Henna, henne	Leaf	lawsonecoumarins, xanthones, flavanoids, naphthoquinines, steroids, fatty acid.	Wounds	42
16.	<i>Morinda citrifolia</i>	Rubiaceae	Morinda citrifolia L.	Indian mulberry	Leaves	scopoletin, catechin, betasitosterol, damnacanthal, alkaloids, lignans.	Wounds	43
17.	<i>Morinda citrifolia</i>	Rubiaceae	Morinda citrifolia L.	Indian mulberry	Leaves	Carbohydrates, dietary fibres, iron, potassium, calcium, vit.C, sodium, niacin	Wounds	43, 44
18.	<i>Murraya koenigii</i>	Rutaceae	KoengiiMur	barsanga, gandhelu.	Leaf	mahanimbine, girinimbine, koenimbine, isomahanine, mahanine, undecalactone, 2-methoxy-3-methyl-carbazole.	Antioxidant, antibacterial	45, 46
19.	<i>Myristica andamanica</i>	Myristicaceae	Myristica andamanica	Jayaphal,jati-phal	Aerial parts	sabinene, myristicin, elemicin, saffrole, mace oil.	Wounds	47
20.	<i>Napoleona Imperialis</i>	Lecythidaceae	Napoleona Imperialis	Umuahia	Leaf	Saponin (0.75%), tannin (333.4mg/kg/5g, phenol, alkaloids0.8%.	Antihypertensive,wounds	48, 49
21.	<i>Prosopis cineraria</i>	Leguminosae	Prosopis cineraria L.	Janti, banni, jand, sangri, chaunkra, khejiri.	Aerial parts	Methyl nonacosanoate, tricosan-1-ol,methyl octadec-9-enoate	Analgesic, Antihelminthic	50
22.	<i>Pterocarpus marsupium</i>	Papilionaceae	Pterocarpus marsupium	Gummy kino, gammalu, kino, Malabar kino tree	Stem bark	marsupin, pterosupin, liquiritigenin, isoliquiritigenin, carpusin, kinoin, kino-red, epicatechin, marsupinol	Boils, sores, skin diseases	51
23.	<i>Pterocarpus santalinus</i>	Fabaceae	Pterocarpus santalinus L.	lal chandan, rakta chandan	Leaf, stem	phenols, anthocyanin, saponin, triterpenoids, flavanoids, tannins, glycerides, glycosides,	Cuts, wounds, boils, inflammation	52

24.	<i>Radix paeoniae</i>	Paeoniaceae	Radix paeoniae alba.	white peony, peony, peony root, mudan	Roots	paeoniflorin (0.05-6.01%), n-hexadecanoic acid,	Hepatoprotective	53
25.	<i>Salvia splendens</i>	Lamiaceae	Salvia splendens	scarlet sage, red salvia	Leaves	spathulenol (38.73%), caryophyllene (10.32%), ledol(45.85), phytol (41.46%), beta-cubebene (22.9%).	Emetic, dysentery	54
26.	<i>Saussurea lappa</i>	Asteraceae	Saussurea lappa C.B Clarke	Kuth	Roots	costunolide, dehydrocostus lactone, cynaropicrinla, dilactone, germacrenes.	Asthma, bronchitis	55
27.	<i>Sesamum indicum</i>	Pedaliaceae	sesamum indicum L.	Til, kali til, Saphed til	Roots	sesame seeds (up to 60% oil), 30% protein, vitamin E, B-complex vitamins (niacin), folic acid, magnesium, phosphorous, calcium,	wounds	56
28.	<i>Solanum violaceum</i>	Solanaceae	Solanum violaceum L.	Phutki, baikur, tit begun	Leaf	steroidal alkaloids (1.8%), solanine, solanidine, solasodine	Rheumatic pains, wounds	58
29.	<i>Terminalia bellirica</i>	Combretaceae	belleric myrobalan	baheda, bahera	Fruits	glucoside, gallo-tannic acid, resins, ellargic acid, lignans, ethyl gallate, galloyl glucose andchebulaginic acid, phenyllembelin, mannitol, fructose, rhamnose.	Wound, antiseptic	59
30.	<i>Tinospora cardifolia</i>	Menispermaceae	Tinospora cardifolia	Guduchi	Stem, leaves	terpenoids, alkaloids, steroids, lignans	Ulcers, leprosy	60
31.	<i>Tragia involucrata</i>	Euphorbiaceae	Tragia involucrata	bichchuti, lata bichchuti, beshani	Roots	Tannins, flavanoids, alkaloids, saponins.	Pain, wounds, swellings, Eczema	61
32.	<i>Trigonella foenumgraecum</i>	Fabaceae	Trigonella foenum graecum	Asumodhagam, greek hay, methi.	Seeds, Aerial parts	alkaloids, amino acids, saponins, steroidal saponogens, fibres	Reduces appetite	62
33.	<i>Vernonia arborea</i>	Asteraceae	Vernonia arborea	Karana, Sadagai, Shutthai.	Leaf, Bark	alpha-amyrin acetate, beta-amyrin, lupeol, stigmasterol, beta-sitosterol	Wounds	63 64
34.	<i>Vitex pinnata</i>	Verbenaceae	vitex pinnata L.	leban tandok, tinnok, kyetyoh	Leaves	flavone glycoside, lignans, Ecdysteroids, Pinnatoside iridoid glucoside	Analgesic, anti-inflammatory, antipyretic.	65
35.	<i>Abrus precatorius</i>	Fabaceae	Abrus precatorius Linn.	Gunchi, Gunja, Mulati	Leaves	Glycyrrhizin, Triterpene glycosides, pinitol and alkaloids suchas asabrine, hepaphotone, choline and precatorine.	Used in Folk medicine to treat Cuts and Wounds.	66, 67
36.	<i>Acalypha langiana</i>	Euphorbiaceae	Acalypha langiana L.	khokali, khokli, khokla, kholi, kuppi, kuppu, kuppikhokli.	Leaves	acalyphine and triacetone amine, cyanogenic glucosides and alkaloids.	On External Human Wounds.	68

37.	<i>Cassia fistula</i>	Fabaceae	Cassia fistula L.	amaltās , bendra lathi , bandarlauri, dhanbaher , dhanbohar, g irimaloah, golden shower tree	Levaeas	anthraquinones, fistulic acid, rheim, rheinglucoside, sennosoides A and B, phlobaphenes, lupeol, emodin, chrysophanic acid, beta-sitosterol and hexacosanol, fistuacacidin,	Human wounds	69
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Table 5: Plants having wound healing activity with their models (Indian origin)

Plant Name	Family	Chemical Constituents	Part and Extract Used	Model Studied	Ref
<i>Ageratum conyzoides</i>	Asteraceae	Monoterpenes(6.4%),oxygenated ,monoterpenoides(0.08-1.4%), sesquiterpenes( 5.1%),phenylpropanoides and benzanoides(2,33%),o-cadinene(4.3%),caryophyllene epoxide(0.5%)etc.	Root, alcohol	Excision wound healing model	71
<i>Andrographis paniculata</i>	Acanthaceae	2-trimetoxy flavone,4-pentamethoxyflavone,dihydroneobaicalein, andrographidine A, andrographidine B, beta-sitosterol etc.	Leaf, alcohol, pet ether& aqueous	Excision, incision, dead space	72 73
<i>Butea monosperma</i>	Fabaceae	Butrin(1.5%), butein (0.3%),butin(0.04%),flavanoides ,steroids.	Bark, alcohol	Excision	74 75
<i>Bryophyllum pinnatum</i>	Crassulaceae	phenols,triterpenoides,steroids,fatty acids,clionasterol,codisterol,clerosterol.	Leaf, alcohol	Excision	76 77
<i>Calotropis gigantean</i>	Apocynaceae	Usharin,gigantin,calcium oxalate,alpha &beta- calotropeol,beta-amyrin.	Latex	Excision and incision	78 79
<i>Colutea Cilicia</i>	Fabaceae	Flavanoids,sterols,quinine,sterol,tannins,galllic acid,caffeic acid,myricetin	Fruit & leaf, aqueous	Excision and incision	80
<i>Colebrookea oppositifolia</i>	Lamiaceae	chrysin,negletein,quercetin,triacontanol,palmitic,oleic,stearic acid,beta-sitosterol	Leaf, alcohol	Excision, incision	81 82
<i>Crotalaria verrucosain</i>	Fabaceae	crotalaburnine,crotaverrine,iso-senkirkine, crotaverrine acetate,isovitexin,apigenin o-glycoside	Aqueous	Excision and incision, dead space	83
<i>Cordia dichotoma</i>	Boraginaceae	alpha-amyrin,betulin,octacosanol,lupeol 3-rhamnoside,beta-sitosterol,bohenic,oleic acid	Fruit, alcohol	Excision, incision ,dead space	84
<i>Datura alba</i>	Solanaceae	saponin,tannin,glycosides,flavanoid,steroid ,terpenoides	Leaf, alcohol	Burn wound	85 86
<i>Dissotis theifolia</i>	Melastomataceae	saponin, glycoside,steroids,tannin,saponin,alkaloids ,carbohydrates.	Stem, methanol	Excision model	87 88
<i>Elaeis guineensis</i>	Arecaceae	Palmitic,stearic,oleic,oleodapalmitins,palmitidioleins,linoleodioleinsdiapalmitistearin	Leaf, methanol	Excision model	89, 90
<i>Euphorbia neriifolia</i>	Euphobiaceae	Sugar ,tannin, flavanoids, triterpenoids, saponin	Latex, aqueous	Excision	91 92
<i>Echinops echinatus</i>	Asteraceae	7-hydroxyisoflavone,kaempferol-4-methylether,kaempferol-7-methylether,myricetin-3-o-a-L-rhamnoside,kaempferol-3-o-L-rhamnoside.	Root, petroleum ether, chloroform, ethanol and distilled water	Excision, incision, dead space	93 94

Elephantopus scaber	Asteraceae	Sesquiterpene lactones, triterpenoids, steroids, flavanoids, elephantopin	Whole plant, ethanol & aqueous	Excision, incision, dead space	95 96
Glycyrrhiza glabra	Fabaceae	Glycyrrhizin, glycyrrhetic, liquiritic acid	Root, ethanol	Excision	97 98
Gentiana lutea	Gentianaceae	Secoiridoid glycoside amarogentin, gentiopicrin	Rhizomes, alcohol and petroleum ether	Excision, incision, dead space	99 100
Glycosmis pentaphylla	Rutaceae	Glucosmin, phlobaphene, glycoquinone, glycoctrine.	Leaf, methanol	Excision	101 102
Hippophae rhamnoides	Elaeagnaceae,	Oleanolic acid, ursolic acid, dulcic acid, cirsiumaldehyde, octacosanoic acid, 19-alpha-hydroxyursolic acid	Leaf, aqueous	Excision	103 104
Heliotropium indicum	Boraginaceae	Alkaloids, saponin, phlobotamins, steroids, flavanoids, tannin, glycosides, coumarins.	Whole plant, ethanol	Excision and incision	105 106
Indigofera enneaphylla	Leguminosae	Ethylacetate, alcohol, alkaloids, amino acids, anthraquinone glycosides, flavanoids, saponins, steroids, sugars.	Aerial parts, alcoholic	Excision and incision	107 108
Ixora coccinea	Rubiaceae	Triterpenes (62.60%), sesquiterpenes (3.35%), ursolic acid (27.34%), lupeol (15.10%), geranyl acetate (8.74%).	Flower, alcohol	Dead space	109
Jatropha curcas	Euphorbiaceae	Oleic acid (41.5-48.8%), linoleic (34.6-44.4%), stearic (2.3-2.8%), resins, tannins.	Bark,	Excision, incision, dead space	110
Kalanchoe pinnata	Crassulaceae	Bryophyllin A, bersaldegennin-3-acetate, bryophyllin C, alkaloid, tannin, magnesium, calcium, ascorbic acid.	Leaf, ethanol	Excision wound model	111
Napoleona imperialis	Lecythidaceae	Carbohydrate (9.95%), fat (1.0%), fibre (2.5%), protein (0.4%), moisture (80.5%), fat, protein.	Leaf, methanol	Excision model	112
Ocimum sanctum	Lamiaceae	Oleanolic acid, ursolic acid, eugenol, carnacrol, linalool, rosmarinic acid, germacrene D (2%).	Leaves, alcoholic and aqueous	Leaves, alcoholic and aqueous	113
Quercus infectoria	Fagaceae	Tannin (50-70%), syringic acid, beta-sitosterol, amentoflavone, hexamethyl ether, isocryptomerin, methyl betulate, methyl oleanate.	Leaf, ethanol	Excision, incision, dead space	114
Rubia cardifolia	Rubiaceae	Alizarin, alkaloids, anthraquinones, carbohydrates, coumarins, glycosides, proteins, saponins, steroids.	Roots, alcoholic extract	Excision wound model	115 116
Rubus sanctus	Rosaceae	Quercetin, kaempferol, trifolin, hyperin, chlorogenic acid, caffeic acid, glucose-caffeoyl ester	n-hexane, chloroform, ethyl acetate and methanol	Excision and incision	117
Solanum xanthocarpum	Solanaceae	Alkaloid, sterols, saponins, glycosides, flavanoids, amino acid, fatty acids	Fruit, methanol	Excision and incision	115
Vinca rosea	Apocynaceae	Vincristine, vinblastine, rosinidine.	Leaf, ethanol	Excision model	118 119



**CONCLUSION:**

Wound healing is a process that starts with trauma and ends with scar formation. The goal of wound care is to enhance the healing process and reduce the risk factors. This review covers various types of reported medicinal plants that are used for wound healing and models used for wound healing.

**REFERENCES:**

1. Esimone, CO, Ibezim EC, Chah, KF, et al. Factors affecting wound healing. *Journal of Pharmaceutical Allied Sciences*. 2005; 3(1):294-299.
2. Avinash G, Priyanka B, et al. Wound healing potential of indian medicinal plants. *International journal of pharmacy review and research*. 2013; 2: 75-87.
3. Mittal A, Sardana S, Pandey, A, et al. Herbal boon for wounds. *International Journal of Pharmacy and Pharmaceutical Sciences*. 2013; 5:1-12.
4. Yogesh S, Jeyabalan G, Ramandeep S, et al. Current aspects of wound healing agents from medicinal plants. *Journal of medicinal plants studies*. 2013; 1:1-11.
5. Alam G, Singh MP, et al. Wound healing potential of some medicinal plants. *International Journal of Pharmaceutical sciences Review and Research*. 2011; 9: 136-145.
6. Sudha Bhargavi, Amaresh Kumar, Ranjith Babu, et al. Ancient and Modern View of Wound Healing: Therapeutic Treatments. *Research Journal of Pharmaceutical, Biological and Chemical Sciences*. 2011; 2(3): 474.
7. Amaresh Kumar, Pavan Kumar, Ranjith Babu et al. Review Article of Ancient and Modern View of Wound Healing: Therapeutic Treatments. *Research Journal of Pharmaceutical, Biological and Chemical*. 2011; 2: 475.
8. Lazarus GS, Cooper DM, Knighton DR et al. Definitions and guidelines for assessment of wounds and evaluation of healing. *Archives of dermatology*. 1994; 130: 489-493.
9. Menke NB, Ward KR, Witten TM, et al. Impaired wound healing. *Clinical Dermatology*. 2007; 25: 19-25.
10. Velnar T, Bailey T, Smrkolj V, et al. The wound healing Process: An overview of the cellular and molecular mechanism. *Journal of international Medical Research*. 2009; 37: 1528-1542.
11. DuBuc T Q, Traylor K N, Martindale M Q, et al. Cellular and molecular features of wound healing Initiating a regenerative response in the cnidarian *Nematostella vectensis*. *Journal of B.M.C. Biology*. 2014; 12:20.
12. Kiwanuka E, Eriksson E, et al. Harnessing growth factors to influence wound healing. *Clinics in Plastic Surgery*. 2012; 39: 239-248.
13. Guo S, DiPietro LA, et al. Wound Healing and Tissue Regeneration. 2010; 3: 219-229.
14. Badri P N, Renu S, et al. Role of Medicinal Plants in Wound Healing. *Research Journal of Medicinal Plants*. 2011; 4: 392-405.
15. Hess CT, et al. Understanding the barriers to healing. *Advanced skin wound care*. 2012; 25: 239-240.
16. Sabale P, Bhimani B, Prajapati, et al. An overview of medicinal plants as wound healers. *Journal of applied Pharmaceutical Science*. 2012; 2: 143-150.
17. Barrientos S, Stojadinovic O, Golinko MS, Brem H, et al. Growth factors and cytokines in wound healing. *Wound Repair and Regeneration*. 2008; 16: 585-601.
18. Guo S, DiPietro LA, et al. Wound Healing and Tissue Regeneration. 2010; 3: 219-229.
19. Adeir Moreira Rocha, Beatriz Juliao Vieira, et al. Effects of low-level laser therapy on the progress of wound healing in humans. 2007; 6: 258-266.
20. Sibbald GR, Woo K, Ayello AE, et al. Increased bacterial burden and infection: The story of Nerds and Stones. *Advances in skin & wound care*. 2006; 19: 447-461.
21. Tsokos M, Heinemann A, Puschel K, et al. Pressure sores: epidemiology, medico-legal implications and forensic

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- argumentation concerning causality. *International Journal Legal Medicines*. 2000; 113: 283-287.
22. Canales M, T Hernandez, M.A Roudriguez-Monroy, C.M Flores, M Jimenez, et al. Evaluation of antimicrobial activity of *Acalypha monostachya*: (Euphorbiaceae). *African Journal of Pharmacy and pharmacology*. 2011; 5(5): 640-647.
  23. Chitra, Ilango K, et al. *Tropical Journal of Pharmaceutical Research*. 2010; 9(3): 223-230.
  24. Sajithlal GB, et al. Influence of aloe vera on collagen turnover in healing of dermal wounds in rats. *Indian Journal of Experimental Biology*. 2000; 36: 896-901.
  25. Subhashini T, Krishnaveni B, Srinivas Reddy, et al. Anti inflammatory activity of leaf extract of *Alternanthera sessilis*. 2010; 2(1): 54-56.
  26. Pujar PP, Swaikar, et al. A new germacranolide from a pallens. *Journal of Pharmacognosy*. 2000; 5: 590-2.
  27. Barua Talukdar, et al. A evaluation of wound healing activity of methanolic extract of *Azadirachta Indica* in rats. *Pharmacology online*. 2010; 1: 70-77.
  28. Don G, Rashmi Y, et al. A study of phytochemical constituents and pharmacological actions of *Trigonella foenumgraecum*. *International journal of pharmacy and technology*. 2011; 3: 1022-1028.
  29. Praveen kumar, Nishteswar K et al. Phytochemical and Pharmacological profiles of *Clerodendron Serratum*: A review. *International Journal of Research Ayurveda Pharm*. 2011; 4(2): 3276-278.
  30. Chandra Shekar, Acute central and peripheral analgesic activity of ethanolic extract of the leaves of *clerodendrum viscosum* (eecv) in rodent models, *Journal of Drug Delivery & Therapeutics*, 2012; 2(5): 105-108
  31. Kaliyaperumal Ashokkumar, Kuamrakurubaran selvaraj, Saradha Devi, Muthukrishnan, et al. *Cynodon dactylon*: An updated review of its Photochemistry and Pharmacology. *Journal of Medicinal plants Research*. 2013; 7(48): 3477-3483.
  32. Asthana Amrita, Kumar Anil, Gangwar Sumit et al. Pharmacological perspectives of *cynodon dactylon*. *Research journal of Pharmaceutical, Biological and Chemical Sciences*. 2010; 2: 71-76.
  33. Wang Limei, Waltenberger Birgit, Pferschy Wenzig, Blunder Martina, Liu Xin, et al. Natural product agonists of peroxisome proliferator-activated receptor gamma (PPAR $\gamma$ ): A review. *Biochemical Pharmacology*. 2014; 92 (1): 73-89.
  34. Jian S, Wang L, Nan P, Zhong Y, et al. Chemical composition of the essential oil of *Elephantopus scaber* from Southern China. *Nat. J. Med*. 2004; 59(5-6): 327-9.
  35. Sandeep B, Patil, Nilofar Naikwad, Chandrakant Magdum, et al. Review on Phytochemistry and Pharmacological aspects of *Euphorbia hirta* linn. *Journal of pharmaceutical research health care*. 2009; 1: 113-133.
  36. Kumar S, Malhotra R, Kumar D, et al. *Euphorbia hirta*: Its chemistry, traditional and medicinal uses, and pharmacological activities. *Journal of Pharmacognosy Review*. 2010; 4 (7): 58-61.
  37. Bairy kL, et al. Wound healing profile of *Gingko Biloba*. *Journal of Natural Remedies*. 2001; 25-27.
  38. S Pimenta, et al. Floral biology and artificial polinization in phydic nut. *International Journal Medicinal Plants*. 2009; 9: 1073-1077.

39. Jones CD, et al. A review of *Jatropha curcas*: an oil plant of unfulfilled promise. The Genetic Basis of Drosophila sechellia's Resistance to a Host Plant Toxin. *International Journal Medicinal Plants*. 2000; 19(1): 1-15.
40. Muhammad I U, et al. *African Journal of pharmacy & pharmacology*. 2011; 5:1638-1647.
41. Orthan I, kupeli E, et al. *Journal of Ethnopharmacology*. 2007; 1:146-50.
42. Nizam Uddin, Bin S et al. *International centre for chemical and biological sciences*. 2013; 35: 476.
43. Deng, Shixin, Palu, et al. *Journal of natural product*. 2007; 5:859-62.
44. Morton J, et al. The ocean-going noni, or Indian Mulberry (*Morinda citrifolia*, Rubiaceae) and some of its "colorful" relatives. *Economic Botany*. 1992; 149 (4): 1899–1908.
45. Harish K, Handral, Anup Pandith, Shruthi, et al. A review on *Murraya Koenigii*: Multipotential Medicinal Plant. *Asian Journal of Pharmaceutical Clinical Research*. 2012; 5: 5-14.
46. Jain Vandana, Momin Munira, Laddha Kirti, et al. *Murraya Koenigii*: An Updated Review . *International Journal Of Ayurvedic And Herbal Medicine*. 2012; 4: 607-627.
47. Gopalkrishnan M, et al. Chemical composition and mace. *Journal of spices aromatic crops*. 1992; 1: 49-54.
48. Martin Chukwudi Uchegbu, Cynthia Okere, Ifeanyi Princewill, et al. Evaluation of Proximate and Phytochemical Compositions of Fermented Raw and Fermented *Napoleona Imperialis* Seed and Their Feeding Values on Finisher Broilers. *Nature and Science*. 2010; 8(4).
49. Alaekwe Ikenna obiora, Mojekwu Okwuchukwu, et al. Composition and Utilization of *Napoleona imperialis* Fruits. *Journal of Natural Sciences Research*. 2013; 3: 160.
50. Stella Robertson, N Narayana, Ravi Nargis, et al. Toxicity evaluation on hydroalcoholic extract of leaf and stem bark of *Prosopis Cineria*. *International Journal of Pharmacy and Pcutical Sciences*. 2012; 4(3):113-118.
51. Patil Hari, Dattatraya K, et al. Review Article *Pterocarpus Marsupium*: A valuable medicinal plant in diabetes management. *International Journal of Applied Biology and Pharmaceutical Technology*. 2011; 2: 0976-4550.
52. Bhawana P, Divya G, et al. Physicochemical analysis of *Pterocarpus santalinus*. *Indian Journal of Science Research*. 2014; 1:201-204.
53. Shunjun Xu, Liu Yang, Runtao Tian. Species differentiation and quality assessment of *Radix Paoniae Rubra* (Chi-shao) by means of high-performance liquid chromatographic fingerprint. *Journal of chromatography* .2009; 11: 2163-2168.
54. Mathew AD, Taranalli AD, Torgal SS, et al. *Journal of Pharmaceutical Biology* 2004; 42: 8–12.
55. K Madhuri, K Elango, S Ponnusankar, et al. Review of its traditional uses, phytochemistry and pharmacology. 2011.
56. Congo Brazzaville, M Nzikou, Matos G, Bouanga Kalou et al. Chemical Composition on the Seeds and Oil of Sesame (*Sesamum indicum* L.). *Advance Journal of Food Science and Technology*. 2009; 1(1): 6-11.
57. Ndangui B, Pambou Tobi, Kimbonguila Silou, Linder Desobry, et al. Nutritional, Medicinal and Industrial Uses of Sesame (*Sesamum indicum* L.) Seeds - An Overview. 2010; 75: 159-168.
58. Yelne MB, Sharma PC, Pcognostic study of *Brahati* :root and fruit. 1989; 11 : 70-83.
59. Saraswathi Motamarri , et al. *Terminalia bellirica*. A review. *International journal of research in pharmaceutical sciences*. (2012), (3).
60. Kirti S, NP Mishra, J Singh, et al. *Tinospora cardifolia*, a reservoir plant for therapeutic applicant. *Indian Journal of Traditional Knowledge*. 2004; 3: 257-270.
61. Venkat Rao N, et al. Pharmacological evaluation of root extracts of *tragia involucrata*. *International Journal Pharmaceutical Science Drug Research*. 2007; (2): 236-244.
62. Rashmi Y, G. Don, et al. A study of phytochemical constituents and pharmacological actions of *Trigonella foenumgraecum*. *International journal of pharmacy and technology*. 2011; 3:1022-1028.
63. Ahsanul Haque, Musfizur Hassan, Atanu Das, Bilkis Begum, Yousuf Ali, et al. Phytochemical investigation of *Vernonia cinerea* (Family: Asteraceae). *Journal of Applied Pharmaceutical Science*. 2012; 2(6):79-83.
64. D Pradhan, PK Panda, G Tripathy, et al. Wound healing activity of methanolic and aqueous extract of *Vernonia arborea* buch. *Natural product radiance*. 2009; 8(1): 6-11.
65. Anita R, Anupam S, et al. The genus *Vitex*. A review of pharmacognosy. *Journal of pharmacognosy*. 2013; 14: 188–198.
66. Anam EM, et al. Antiinflammatory activity of compounds isolated from the aerial parts of *Abrus precatorius* (Fabaceae) Phytomedicine. . *Journal of Phytomed*. 2001; 8(1): 24-7.
67. Meena Prabha, Chendraya Perumal, Praveen Kumar, Soundarajan, S Srinivasan, et al. Review Article Pharmacological activities of *Abrus precatorius* (L.) seeds . *International Journal of Pharmaceutical and Medicinal Research Journal homepage*. 2015; 3(2):195-200.
68. Schmelzer G.H, Gurib-Fakim, et al. *Plant Resources of Tropical Africa Medicinal*.
69. Rajagopal PL, Premaletha K et al. *International Journal of pharmaceutical, chemical and biological sciences*. 2013; 3:672-679.
70. Jain S, Jain N, Tiwari A, Balekar N, Jain D K, et al. *Asian Journal of Research Chem*. 2009; 2: 135-138.
71. Anjoo Kamboj, Ajay Kumar Saluja, et al. *Bryophyllum pinnatum* (Lam.) Kurz: A review on Phytochemical and pharmacological profile. 2009; 6: 364-374.
72. Chimkode R, Patil M B, Sunil S, Reddy Patil N, Nitin Agarwal, Ashish Tripathi, et al.. *International Journal of Pharmacology Biological Sciences*. 2008; 2 (3):153-156.
73. Xu C, Wang ZT, et al. Chemical constituents from root of *Andrographis paniculata*. *Journal of Spectroscopy* .2011; 3: 317-21.
74. Sumitra M, Manikandan P, Suguna L, et al. *International Journal of Biochem Cell Biology*. 2005; 37: 566–573.
75. Firdaus Rana, Mazumder Avijit, et al. Review on *Butea Monosperma*. *International Journal of research in pharmacy and chemistry*. 2012, (4).
76. Khan M, Patil PA, Shobha JC, et al. *Journal of Natural Remedies*. 2004; 4: 41–46.
77. Anjoo K, Ajay K S, et al. *Ageratum conyzoides* L. A review on its phytochemical and pharmacological profile. 2009; 2: 59-68.
78. Narendra nalwaya, Gaurav pokharna, Lokesh deb, Naveen kumar Jain, et al. *International Journal of Pharmaceutical Sciences*. 2009; 1:176-181.
79. Suresh K, Suresh E, S Kalavathy, et al. Review on a potential herb *Calotropis gigantea* (L.). *Scholars Academic Journal of Pharmacy*. 2013; 2: 135-143.
80. Ufuk koca, Ipek Pesin Suntar , Esra kupeli Akkol, Demet Yilmazer Murat Alper et al. eCAM. 2009; 1-7.
81. Madhavan V, Yadav DK, Murali A, Yoganarasimhan SN, et al. *Journal of Indian Drugs*. 2009, 3: 209-213.
82. Smith Varadharajan Madhavan , Dinesh Kumar Yadav , Magadi Gurudeva , Sunkam Yoganarasimhan, et al. Pharmacognostical studies on the leaves of *Colebrookea oppositifolia* Smith. *Asian Journal of Traditional Medicines*. 2011; 4.
83. Eesha B R, Meena kumari, Mohanbabu Amberkar, Sarath babu, Rajsekhar, Neelesh kumar, et al. *APJTM*. 2010; 783-787.
84. Kuppast I J, Vasudeva nayak, et al. *Journal of Natural Product Radiance*. 2006; 2: 99-101.
85. Priya KS, Gnanamani A, Radhakrishnan N, Babu M, et al. *Journal of Ethnopharmacology* .2002; 83: 193–199.
86. Ghias Uddin, Abdur Rauf and Samina Akhtar, et al. Studies on Chemical Constituents, Phytochemical Profile and Pharmacological Action of *Datura alba*. *Middle-East Journal of Medicinal Plants Research*. 2012; 1: 14-18.
87. Odimegwu DC, Ibezim EC, Esimone CO, Nworu CS, Okoye FBC, et al. Wound healing and antibacterial activities of the extract of *Dissotis theifolia* (Melastomataceae) stem

- formulated in a simple ointment base. *Journal of Medicinal Plants Research* .2008; 1; 011-016.
88. Ibezim EC, Esimone CO, Nworu CS, Okoye FBC, et al. Wound healing and antibacterial activities of the extract of *Dissotis theifolia* (Melastomataceae) stem formulated in a simple ointment base. *Journal of Medicinal Plants Research* .2008; 1; 011-016.
89. Sreenivasan Sasidharan, Rajoo Nilawaty, Rathinam Xavier, Lachimanan Yoga Latha Rajoo Amala, et al. *Molecules*. 2010; 15: 3186-3199.
90. Barker TW, Worgan, et al. The utilization of palm oil processing effluents as substrates for microbial protein production by the fungus *Aspergillus oryzae*. *Journal of Applied Microbiology & Biotechnology*.1981; 4: 234-240.
91. Rasik AM, Shukla A, Patnaik GK, Dhawan BN, Kulshrestha DK, Srivastava S, et al. *Indian Journal of Pharmacology*.1996; 28: 107-109.
92. Sheikh Arshad Ahmed, Sayyed Nazim, Shaikh Siraj, et al. A pharmacological review: *Euphorbia neriifolia* linn. *International Research Journal of Pharmacy*. 2011; 5: 41-48.
93. Jagadish N R N, Mohmood R, et al. *Journal of Indian drugs*. 2009; 464: 342-346.
94. Singh B, Gambhir SS, Pandey VB, Joshi VK, et al. Anti-inflammatory activity of *Echinops echinatus*. 1989.
95. Singh SDJ, Krishna V, Mankani KL, Manjunatha BK, Vidya SM, Manohara YN, et al. *Indian Journal of Pharmacology*. 2005; 37: 238-242.
96. Sachin Hiradeve, Vinod D, Ranagri, et al. *Elephantopus scaber* Linn.: A review on its ethnomedical, phytochemical and pharmacological profile. *Journal of Applied Biomedicine*.2014; 12:49-61.
97. Kishore GS, Kumar BS, Ramachandran S, Saravanan M, Sridhar SK, et al. *Indian Drugs*. 2010; 38: 355-357.
98. Kumar Anil, Dora Jyotsna, et al. Review on *Glycyrrhiza glabra*. *Journal of Pharmaceutical and Scientific Innovation*.2012; 1(2):1-4.
99. Mathew AD, Taranalli AD, Torgal SS, et al. *Pharmaceutical Biology*. 2004; 42: 8-12.
100. Katarina Savikin, Nebojsa Menkovic, Gordana Zdunic, et al. Antimicrobial activity of *Gentiana lutea* L. extracts.2009;64:339-342.
101. Megha jha, Versha Sharma, Nitin Nema, Tahziba hussain, et al. *Pharmacologyonline*. 2009; 3; 356-360.
102. Anandhan Vignesh, Rama Purushothaman, et al. Chemical composition and antioxidant activity of essential oil from *Glycosmis pentaphylla*. *International Journal of botany and research*.2014; 4(5):19-28.
103. Gupta A, Kumar R, Pal K, Banerjee PK, Sawhney RC. *Journal of Lower Extremity Wounds*. 2005; 4: 88-92.
104. Geetha Suryakumar, Asheesh gupta, et al. Medicinal and therapeutic potential of sea buckthorn (plant). *Journal of ethnopharmacology*.2011; 138: 268-278.
105. Reddy JS, Rao PR, Reddy MS, et al. *Journal of Ethnopharmacology* .2002; 79: 249-251.
106. Yesmin begum, et al. Antibacterial, Antioxidant and cytotoxic activities of *Heliotropium Indicum*. *International Journal of science and technology*.2014; 23(1):1564-1569.
107. Hemalatha S, Subramanian N, Ravichandran V, Chinnaswamy K, et al. *Indian Journal of Pharmaceutical Sciences* .2001; 63: 331-333.
108. Sivagamy M, Jaganantham NS, Senthamarai R et al. Anti Inflammatory of *Indigofera enneaphylla* Linn.in rats. *International Journal of Pharmaceutical and chemical science* .2012; 1(3):1234.
109. Nayak BS, Udupa AL, Udupa SL, et al. *Fitoterapia* .1999; 70: 233-236.
110. Somashekar Shetty, Udupa SL, Udupa AL, Vollala VR, et al. *Saudi Medical Journal* .2006; 27(10): 1473-1476.
111. Shivananda B, Jullien marshall, Godwin Isitor. *Indian Journal of Experimental Biology* .2010; 48:572-576.
112. Alaekwe, Ikenna obiora, Mojekwu Okwuchukwu, et al. Composition and Utilization of *Napoleona imperialis* Fruits. *Journal of Natural Sciences Research*.2013; 3: 160.
113. Sing, Vishwabhan., Vimal Birendra., Suvagiya Vishal. A review on ethnomedical uses of *Ocimum Sanctum* (Tulsi). *International research journal of Pharmacy*.2011; 2(10):1-3.
114. Sharma Y, Jeyabalan J, Singh R, et al. Current aspects of wound healing agents from Medicinal plants: a review. *Journal of medicinal Plants Studies*.2013; 1: 2320-3862.
115. Ipek Pesin, Ufuk koca, Esra Akkol, Demet Yilmazer, Murat Alper, et al. *Journal of eCAM*. 2009; 1-7.
116. Devi Priya, E.A Siril, et al. Pharmacognostic Studies on Indian Madder (*Rubia cordifolia* L.) *Journal of Pharmacognosy and Phytochemistry*.2013; 1(5): 112-119.
117. Günter Matzke-hajek, Heinriche Weber, et al. A survey of the *Rubus* Species (Rosaceae). *Anales Jardín Botánico de Madrid*. 1999; 57(1): 25-35.
118. Gajalakshmi S, Vijayalakshmi S, Devi Rajeswari, et al. Pharmacological activities of *Catharanthus Roseus*: A Perspective Review. *International Journal of Pharma and Bio Sciences*. 2013; 4(2): 431 - 439.
119. Rajha S, Al Naimi, Eman Tae, et al. Comparative pathological and cytogenetical study of ethanolic extract of *Vinca rosea* L. and Vinblastine in treating mammary gland adenocarcinoma implanted mice. *Kuifa Journal for Veterinary Medical Sciences*. 2011; 2(1): 646.