CHAPTER III

THE ASSOCIATION OF METEREOLOGICAL VARIABLES AND POLLUTANTS WITH INCIDENCE OF RESPIRATORY ILLNESS IN RELATION WITH THE MEDICAL SALE IN VADODARA CITY

3.1 INTRODUCTION

Global warming has given birth to a variety of effects, namely, rising sea levels, altered patterns of agriculture, increased extreme weather events, and the expansion of the range of tropical diseases (Krosnick *et al.*, 2000).From ancient times weather forecast has been major source for a layman to understand the atmospheric conditions. Based on these forecasts, one used to schedule his day-to-day activities and work accordingly. Earlier these forecasts were based solely upon the observations of sky. Today, meteorologists rely heavily on computer models (numerical weather prediction), it is still relatively common to use techniques and conceptual models that were developed before computers were powerful enough to make predictions accurately or efficiently (Hardin, 2003 and Bronnimann *et al.*, 2005). Meteorological parameters like pressure system, wind speed and direction, humidity, temperature and precipitation, ultimately results from the variable relationships of heat, pressure, wind and moisture which is mainly the result of interactions between each of them with change in time. Respiratory illness is the term for diseases of the respiratory system which includes diseases of the lung, pleural cavity, bronchial tubes, trachea, and upper respiratory tract and of the nerves and muscles of breathing. Respiratory diseases range from mild and self-limiting such as the common cold to life-threatening such as asthma. India is predicted to become the world's most populous nation by the year 2050. Industrialization and urban growth are now occurring at an unprecedented rate in this previously agrarian society (Chowgule *et al.*, 1998). Both prevalence and mortality from asthma appear to have increased in many parts of the world during a time when better asthma medications have been available to more patients suffering from asthma (Alderson, 1987).

The economic burden of asthma is estimated to rank as one of the highest among chronic diseases due to the significant healthcare utilization associated with this condition. Varied studies

have been carried out for evaluation of the economic burden of asthma on society and individuals, wherein the efficient review of the financial impact of asthma to know the trend of the disease has not yet been carried out (Gergen, 2001; Woolcock *et al.*, 2001 and Morgan and Khan, 2003).

It is generally thought that some people are born with a genetic predisposition toward developing asthma, but environmental (and potentially societal) factors play a role in the actual development of the disease (Roemer *et al.*, 2000). It is this knowledge that allows scientists to determine ways in which asthma attacks can be prevented or limited. Human biometeorology refers to the relationship of human beings with the natural climatic conditions prevailing in the atmosphere. It studies influence of various meteorological parameters on man in health and disease, his adaptability to alteration in atmospheric environment and role that these changes play in triggering the onset of respiratory illness. Such studies are important because it directs us to implement policies that can improve air quality and help in understanding climatic changes which further facilitates us in humanizing the overall health condition and prevent respiratory illness in future by forming a proper management plan (Mount Sinai Medical Center, 2009).

A study of the burden of a disease is most needed by any health planner who is responsible for making specific plans to combat, contain and eliminate the disease in the population/community. As most planners are economists who prefer to optimize resource allocations based on the financial implications of the problem for the nation and the quantum of expenditure incurred by the population, this chapter documents the current prevalence of asthma in India and the amount of money presently spent by people for treatment, either to get cured or ameliorate suffering.

Demir *et al.*, (2001) in their studies with prevalence of asthma in Turkey have also reported the similar trend. Clinical studies by Klot *et al.*, (2002) have also proved increased asthma medication associated with pollution. Vijaykumar *et al.*, (2009) in their studies have proved Environmental pollution, in discriminate smoking and congested habitat without proper sanitation are the major reasons for the occurrence of asthma among urban populations. In Vadodara city, precise studies are not available to estimate respiratory health related disease burden. Reliable data on mortality and morbidity are scarce in general; they are almost

nonexistent.. Paucity of this adequate data makes the understanding of the public health situation more complex, but one can use indirect evidence for analysis that may reveal the sickness load. But the data from death registration sources are neither reliable nor complete; good percent of cases will go unregistered out of which only 10% of deaths are medically certified. Globally, the economic costs associated with Asthma exceed those of tuberculosis and HIV/AIDS combined (www.who.int/mediacentre/fact sheets, Fact sheet N°307 2001). The economic cost of Asthma is considerable both in terms of direct medical costs (such as hospital admissions and cost of pharmaceuticals) and indirect medical costs (Masoli *et al.,* 2004). Sources like ORG data can also help us indirectly by finding the facts about the economic burden of the diseases by knowing the medical sale.

Keeping the above points in view, the present study is a step forward to understand the relationship between the medical sales of the respiratory diseases in Vadodara city. The present study aimed to verify the results observed by trend analysis by SPSS which proved a strong correlation between meteorological factors and pollutants city and to extend the number of analyzed pollutants and health endpoints. The role of these factors on the increase of medication use was specifically studied. It was hypothesized that increase in pollution level is associated with increase in respiratory illness medication use prevalence. In particular, it was hypothesized that the increasing pollution level may affect on demand medication.

3.2 MATERIALS AND METHOD

3.2.1 Study parameters:

Along with 8 meteorological parameters and 3 Pollutants (as discussed in Chapter 2), sale of 7 Respiratory medicines were considered in this study, the data was obtained from ORG department for year 2005 to 2007. These 18 parameters were then applied on SPSS 12.0, software termed as Statistical Package for Social Sciences version 12.0 (SPSS 12.0). It was through this package that factor analysis study is performed and the extent of interdependence among these 18 parameters and the trend of interdependence for last three years were analyzed. The sale of 325 respiratory medicines categorized under 7 groups :

1. B. Inhalant Preparations
2. B. Inhalers
3. Inhaler Devices
4. B. Liquids
5. B. Injecta
6. B. Solids
7. B. Others

Table 3.1: The list of medicines Considered in The Study

Sr. No.	Name Of Drug
Bronchodil.Inhalant Prep.	
1	Seroflo
2	Asthalin
3	Duolin
4	Foracort
5	Aerocort
6	Budecort
7	Tiova
8	Beclate
9	Asthalin Hfa
10	Simplyone
11	Budamate
12	Formonide
13	Esiflo
14	Combihale-Ff
15	Budate
16	Ipravent
17	Duonase
18	Salbair-I
19	Seretide
20	Metaspray
21	Duova
22	Combihale-Fb
23	Forair
24	Combimist
25	Tiate
26	Pulmicort
27	Vent-Sf
28	Combitide
29	Ventorlin
30	Fullform
31	Levolin
32	Salbair
33	Salbair-B
34	Vent-Fb
35	Maxiflo
36	Tiomate
37	Ciclospray

Sr. No.	Name Of Drug
38	Derinide
39	Flohale
40	Triohale
41	Serobid
42	Duomate
43	Inhalex
44	Momenta
45	Formoflo
46	Budesal
47	Vent Bec
48	M-Spray
49	Ipneb
50	Derisone
51	Aquamet
52	Azeflo
53	Bekform
54	Fomtide
55	Metatop
56	Derihaler
57	Ciclohale
58	Momeflo
59	Combolin
60	Nasicure
61	Foratec
62	Tiotrop
63	Aerovent
64	Budez
65	Duoset
66	Azenate
67	Aerotaz
68	Aerotide
69	Aerovent Dp
70	Asthalin-Ax
71	Asthavent
72	Asthavent Dp
73	Autohaler
74	Avessa
75	Becoride

Sr. No.	Name Of Drug
76	Bricanyl
77	Budavent
78	Budvent
79	Ciclez
80	Combinase-Aq
81	Cromal
82	Deriform
83	Durasal
84	Fomtaz
85	Fomtrop
86	Formosone
87	Ipramist
88	Levair
89	Levair-B
90	Levair-I
91	Megaspray
92	Nezalast
93	Osonide
94	Rheoran-F
95	Rheoran-Sf
96	Rheolin
97	Salmeter
98	Salvent
99	Symbicort
100	Symbiva
101	Tioform Novocarts
102	Tiomist Novocarts
103	Tioform
104	Tiomist
105	Vent
106	Vent Plus
107	Ventiflo
108	Ventoride
109	Ventipra
Bronchodilators Solids	
110	Unicontin-E
111	Montair
112	Deriphyllin
113	Doxobid

Sr. No.	Name Of Drug
114	Montair Plus
115	Asthalin
116	Doxolin
117	Bricanyl
118	Theo Asthalin
119	Zordox
120	Doxiflo
121	Phyllocontin
122	Mucomix
123	Romilast
124	Betaday
125	Theobid D
126	Bambudil
127	Od Phyllin
128	Synasma
129	Telekast
130	Ab Phylline
131	Freefil
132	Eto-Salbetol
133	Telekast-L
134	Alupent
135	Telekast-Plus
136	Doxoril
137	Duralyn
138	Romilast-B
139	Broxine
140	Levolin
141	Theobric Plus
142	Ketasma
143	Ventorlin
144	Doxophyl
145	Butabrom
146	Doxovent
147	Doxoril Plus
148	Montek
149	Codofyline
150	Montus-Bl
151	Salbetol
152	Freeway

Sr. No.	Name Of Drug
153	Unicontin
154	Vent
155	Bromhexine
156	Montek Plus
157	Grilinctus-Bm
158	Asmatide Br
159	Marax
160	Tsr
161	Ventiphylline
162	Asthakind
163	Salbusun-T
164	Tedral-Sa
165	Durasalyn-Drcm
166	Montus
167	Duralyn-Drcm
168	Sal Mucolite
169	Asthafen
170	Durasal
171	Pulmoza
172	Alergin
173	Doxomax
174	Phylin-1
175	Asmapax
176	Doxfree
177	Montemac
178	Erdozet
179	Mucolinc
180	Tritofen
181	Albutamol
182	Lungfyl
183	Abel
184	Airomol
185	Asthafree
186	Astham
187	Astharid
188	Astharid Plus
189	Asthavil
190	Azofen-T
191	Befree

Sr. No.	Name Of Drug
192	Bronkoplus
193	Bronkotab
194	Dericip
195	Derivent
196	Derivent E
197	Emlucast
198	Etosal
199	Etoxin-B
200	Flohale
201	Ketotif
202	M-Kast
203	Monti
204	Montelast
205	Mucodyne
206	Odimont
207	Odimont-Plus
208	Ozaflo
209	Phylobid
210	Privent
211	Respidac
212	Tedral
213	Terphylin
214	Theobid
215	Theobric
216	Theoday
217	Theoresp
218	Theoresp Plus
219	Theostan-Cr
220	T.R. Phyllin
221	Ventair
222	Vent-T
223	Vent Et
224	Xputum
225	Zomont-Theo
Bronchodilators Liquids	
226	Grilinctus-Bm
227	Ambrodil S
228	Ventorlin
229	Respira-Old

Sr. No.	Name Of Drug
230	Khadiradi Gutika
231	Vent-Pd
232	Asthalin
233	Spasma
234	Sal Mucolite
235	Levolin
236	Asmotone Plus
237	Albutamol
238	Tuspel Px
239	Ventiphylline
240	Theo Asthalin
241	Eto-Salbetol
242	Airomol
243	Vasavaleha
244	Efelin-Pd
245	Durasalyn
246	Doxoril
247	Ventryl
248	Doxomax
249	Cadiphylate
250	Bromhexine
251	Bricanyl
252	Doxobid
253	Deriphyllin
254	Theoped
255	Bambudil
256	Euphomin
257	Doxolin
258	Salphyllin-Old
259	Topex-Br-Old
260	Freefil
261	Doxfree
262	Synasma
263	Asthafen
264	Asthafree
265	Broncordil
266	Broncordil-P
267	Broncordil Plus
268	Bronkoplus

Sr. No.	Name Of Drug
269	Bronko
270	Bronko-Ex
271	Bronkotus
272	Derivent
273	Doxiflo
274	Doxovent
275	Epixyl
276	Etoxin-B
277	Filistin
278	Ketotif
279	Mucodyne
280	Respidac
281	Servil
282	Sudex-Br
283	Tritofen
284	Vasavaleha
285	Vasavaleha
286	Vent
287	Vifex
288	Xputum P
Bronchodilators Injecta.	
289	Budecort
290	Mucomix
291	Epitrate
292	Deriphyllin
293	Levolin
294	Bricanyl
295	Efipres
296	Doxovent
297	Doxoril
298	Doxolin
299	Aerovent
300	Delin
301	Theofin
302	Vasocon
Inhaler Device	
303	Rotahaler Transpar
304	Lupihaler
305	Revolizer

Sr. No.	Name Of Drug
306	Zerostat-V
307	Baby Mask
308	Zerostat
309	Spacer
310	Zerostat-Vt Spacer
311	Vent Mate
312	Aerolife
313	Aerotaz
314	Aerotide
315	Easehaler
316	Novolizer

Sr. No.	Name Of Drug
317	Peak Flow Master
318	Respihaler
319	Rheohaler
320	Sunhaler
321	Transpacer
322	Volumatic
Bronchodilators,Others	
323	Asthakind
324	Haleezy
325	Caropram

3.3 RESULTS:

The analysis of 8 of the meteorological parameters for Vadodara city over a period of 3 years, viz. Height of Lowest layer, cloud cover, Maximum temperature, Minimum Temperature, Wind speed, Rainfall, Relative humidity and Vapor pressure, pollutants like SO_2, NO_X and RSPM, with the sale of 7 respiratory medicines categorized under group bronchodilators like inhaler preparations, Inhalers, Liquids, Injecta, Solids, Bronchodilator others and Anti-asthmatics reveals interesting facts. Annual and seasonal variance, component matrix with respective scree plots are represented in **Table 3.2** to **3.39**. There was a distinct difference in the component matrix analysis. On annual basis the meteorological and the pollutants showed a strong co-relation. The analysis has been carried out on seasonal and annual basis. It discloses interdependence of certain parameters for both seasonal and annual observations. The observations for the study were made in terms of total variance and the total number of components extracted, which gives the percentage of interdependence among each of the study parameter considered. Total variance and component matrix tables for 2005, 2006 and 2007 annual as well as seasonal observations explain the interdependence of meteorological parameters in a significant manner.

Table 3.2: Component Matrix For 2005

	Component			
	1	2	3	4
wndspd	-.790	-.286	.487	-.057
MxT	-.278	-.772	-.262	-.140
MnT	-.904	-.244	-.148	-.096
RF	-.837	.365	.188	.063
RH	-.578	.804	.095	-.011
VP	-.873	**.414**	-.034	-.077
CC	-.755	**.419**	.153	.155
LL	**.968**	-.404	-.134	-.115
SO_2	.677	-.192	**.683**	.089
NOx	**.982**	.010	.357	**.260**
RSPM	**.934**	-.252	.119	.045
B.InhlPrep	**.938**	.203	-.236	.149
B.Solids	**.900**	.359	.142	-.050
B.Liquids	**.963**	**.479**	-.137	**.268**
B.Injecta	**.999**	**.408**	-.005	-.265
Inhaler.Device	**.980**	.278	-.437	.123
B.others	.497	.089	**.684**	-.407
Anti.Others	-.348	-.345	.231	.761

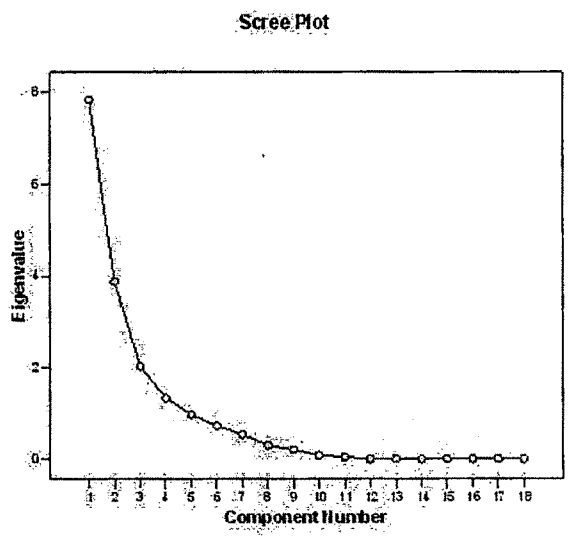

Fig. no. 3.1: Scree Plot For 2005

Table 3.3: Component Matrix For 2006

	Component			
	1	2	3	4
wndspd	**.854**	-.364	.033	.018
MxT	-.126	-.763	.409	.006
MnT	**.885**	-.173	.310	.075
RF	.697	.438	.003	-.204
RH	**.839**	**.636**	-.011	-.094
VP	**.833**	.237	.209	.061
CC	**.892**	.424	-.021	-.016
LL	-.914	-.339	-.144	.057
SO2	-.589	.211	**.688**	.035
NOx	-.606	.114	**.612**	-.237
RSPM	.669	.334	.093	**.577**
B.InhlPrep	-.498	**.656**	-.052	.136
B.Solids	-.409	.218	-.238	**.584**
B.Liquids	-.654	**.645**	.047	-.437
B.Injecta	-.653	**.625**	.143	.198
Inhaler.Device	-.514	**.673**	-.173	.148
B.others	.000	-.204	.620	**.504**
Anti.Others	-.285	-.574	-.471	.120

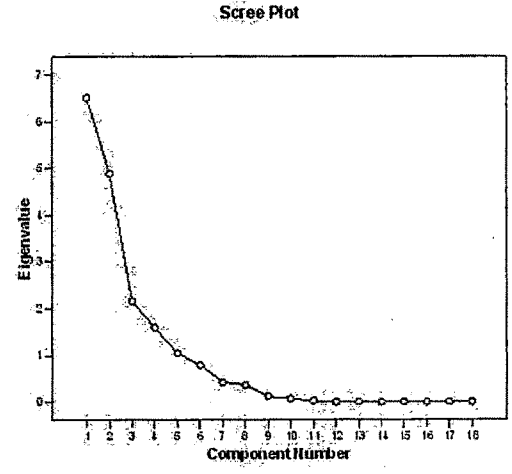

Fig. no. 3.2: Scree Plot For 2006

Table 3.4: Component Matrix For 2007

	Component				
	1	2	3	4	5
wndspd	-.799	-.320	.305	.186	.052
MxT	-.114	-.678	.023	**.496**	**.301**
MnT	-.848	-.051	-.075	**.437**	.080
RF	-.745	.488	.211	-.187	-.035
RH	-.646	**.876**	.179	-.261	-.071
VP	-.879	.360	.191	.164	.059
CC	-.784	.537	.184	-.136	-.058
LL	**.852**	-.463	-.159	.083	-.023
SO_2	.481	-.210	**.668**	.119	-.460
NOx	.347	-.255	**.622**	.201	-.247
RSPM	.401	-.214	**.663**	-.473	**.386**
B.InhlPrep	.507	**.804**	.050	.193	.156
B.Solids	**.830**	.445	.342	-.159	.139
B.Liquids	.521	**.822**	-.228	-.136	.127
B.Injecta	.371	.460	.459	**.448**	**.329**
Inhaler.Device	.421	**.825**	-.172	.281	.160
B.others	.408	.577	-.292	**.431**	-.489
Anti.Others	.062	-.494	-.327	-.335	**.374**

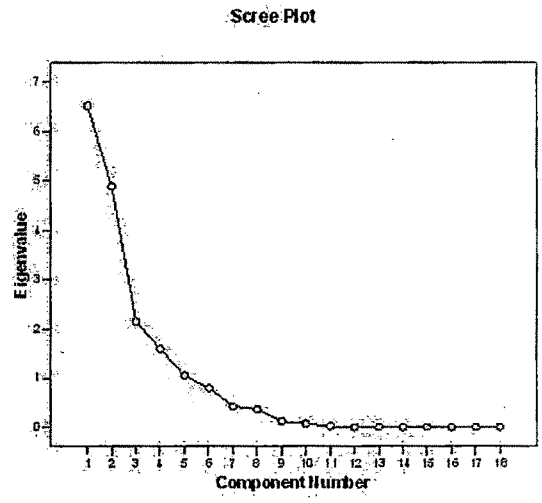

Fig. no. 3.3: Scree Plot For 2007

Table 3.5: Component matrix for 2008 Annual.

	Component			
	1	2	3	4
wndspd	-.064	-.851	-.165	-.082
MxT	-.608	-.478	.486	.357
MnT	.213	-.820	.365	.312
RF	**.884**	-.341	.096	-.166
RH	**.829**	-.275	.103	.116
VP	**.828**	-.276	.103	.121
CC	.387	-.668	.226	-.082
LL	-.935	.203	-.051	-.121
SO_2	-.515	-.101	.223	.726
NO_X	-.824	-.014	.307	.365
RSPM	-.206	**.894**	-.046	.292
B.Inhaler	**.814**	.539	.015	.323
B.Solids	-.263	.295	**.731**	-.534
B.Liquids	.698	.544	.263	-.078
B.Injecta	-.270	.194	**.776**	-.519
Inhaler.Devices	.450	.467	.487	.407
B.Others	.504	**.892**	.049	.128
Anti.Others	-.225	.143	-.522	-.089

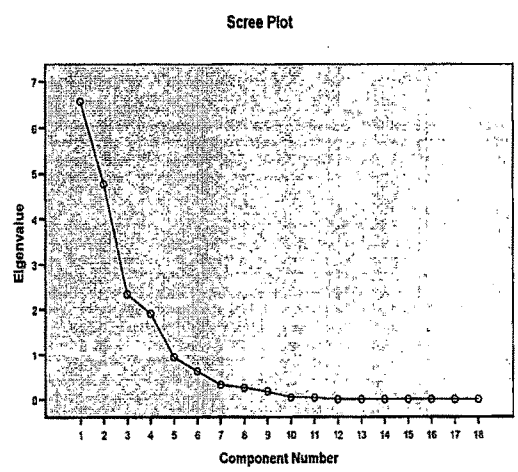

Fig. no. 3.4: Scree Plot For 2008

Table 3.6: Component matrix for 2009 Annual.

	Component				
	1	2	3	4	5
wndspd	.195	.772	.004	.139	**.323**
MxT	**.807**	.314	-.336	.281	.035
MnT	.338	.790	-.288	.320	-.035
RF	.148	.689	.254	-.446	-.211
RH	-.270	.763	.323	-.406	-.001
VP	.123	.964	-.148	-.096	.109
CC	-.268	.679	-.366	-.070	**.394**
LL	-.050	-.781	.084	.463	.064
SO_2	.690	.251	.532	.283	.183
NO_X	**.842**	.214	.441	.094	.090
RSPM	.620	.484	.275	.398	-.078
InhlPrep	-.873	.076	.352	.143	.263
solids	**.824**	-.221	-.093	-.208	-.140
liquids	-.922	.144	.170	.161	.208
Injecta	-.300	.348	-.736	.176	-.192
Inhaler	-.548	.436	.128	.325	-.581
B.other	-.919	.231	.050	.162	.185
AntiOther	.484	-.486	-.251	-.135	**.392**

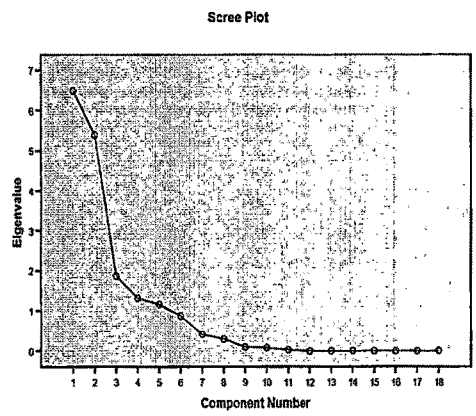

Fig. no. 3.5: Scree Plot For 2009

Table 3.7: Component matrix for 2010 Annual.

	Component		
	1	2	3
wndspd	.382	**.606**	.466
MxT	.046	.508	.821
MnT	.579	**.605**	.148
RF	**.819**	.454	-.418
RH	**.829**	-.087	-.512
VP	**.856**	.483	-.005
CC	**.899**	.337	-.234
LL	-.835	-.495	.165
SO_2	.024	-.911	.064
NO_X	-.674	.057	-.401
RSPM	-.042	.199	.663
InhlPrep	**.862**	-.627	.099
solids	-.747	**.619**	-.214
liquids	**.883**	-.599	.117
Injecta	.587	-.769	.152
Inhaler	.595	-.026	.340
B.other	**.899**	-.541	.140
AntiOther	**.882**	.445	-.253

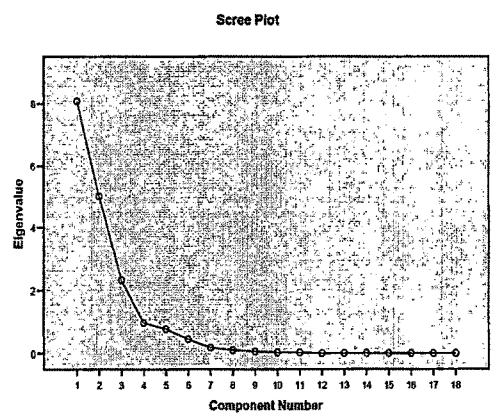

Fig. no. 3.6: Scree Plot For 2010

Table 3.8: Component Matrix For 2005 Summer

	Component		
	1	2	3
wndspd	-.998	-.057	.028
MxT	-.263	-.923	.281
MnT	-.891	-.452	.033
RF	-.759	**.305**	**.510**
RH	-.874	**.356**	.167
VP	-.980	.184	.082
CC	-.674	**.352**	**.550**
LL	**.829**	-.390	-.400
SO_2	**.820**	**.386**	-.066
NOx	**.842**	**.320**	.099
RSPM	**.881**	-.145	.129
B.InhlPrep	**.874**	.091	-.208
B.Solids	**.832**	**.322**	.287
B.Liquids	**.857**	.499	.131
B.Injecta	**.869**	-.189	.158
Inhaler.Device	**.841**	-.338	**.580**
B.others	.448	-.694	**.563**
Anti.Others	**.873**	**.388**	.393

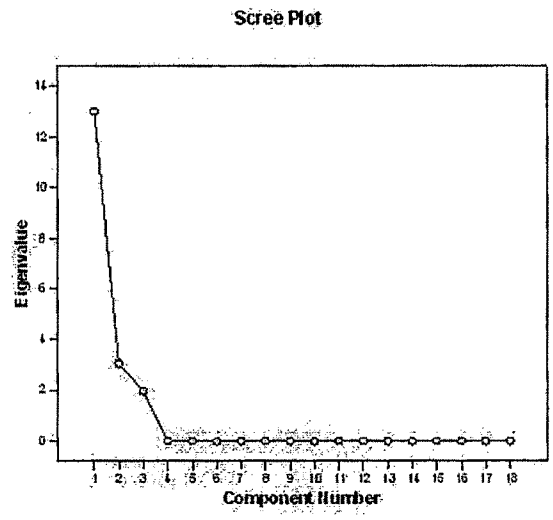

Fig. no. 3.7: Scree Plot For 2005 Summer

Table 3.9: Component Matrix For 2006 Summer

	Component		
	1	2	3
wndspd	**.889**	-.069	.130
MxT	-.449	-.630	**.634**
MnT	**.891**	-.381	.247
RF	**.883**	**.495**	-.182
RH	**.879**	**.463**	.117
VP	**.879**	.121	.166
CC	**.854**	.253	.160
LL	-.892	-.269	-.364
SO_2	-.954	-.291	.074
NO_X	-.912	.399	.093
RSPM	**.886**	-.166	.028
B.InhlPrep	-.736	.213	**.643**
B.Solids	.287	.943	-.167
B.Liquids	-.875	**.485**	-.001
B.Injecta	-.910	.120	.397
Inhaler.Device	-.781	**.488**	-.213
B.others	.560	-.826	-.060
Anti.Others	-.343	-.707	-.618

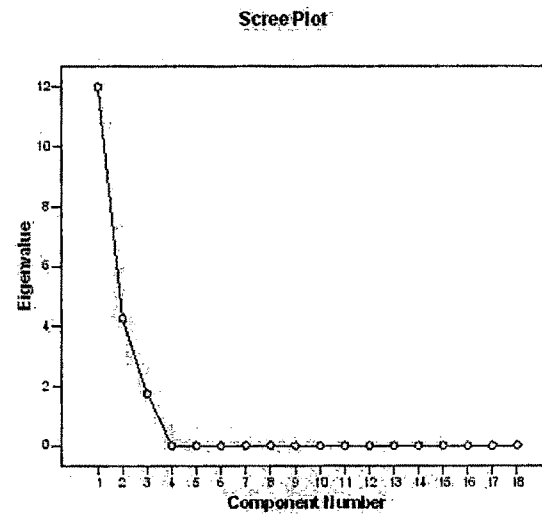

Fig. no.3.8: Scree Plot For 2006 Summer

Table 3.10: Component Matrix For 2007 Summer

	Component		
	1	2	3
wndspd	-.928	-.364	-.075
MxT	.517	-.153	.842
MnT	-.812	-.580	-.072
RF	-.753	.338	**.664**
RH	-.946	.250	.205
VP	-.977	-.110	.181
CC	-.860	.231	**.654**
LL	**.906**	-.239	-.350
SO_2	.355	-.669	**.654**
NO_X	-.449	-.511	-.733
RSPM	.569	-.465	**.679**
B.InhlPrep	**.938**	-.002	.348
B.Solids	.686	**.825**	-.066
B.Liquids	**.945**	.519	-.130
B.Injecta	.606	-.487	-.629
Inhaler.Device	**.973**	-.086	.214
B.others	-.475	**.879**	-.040
Anti.Others	.209	**.872**	-.113

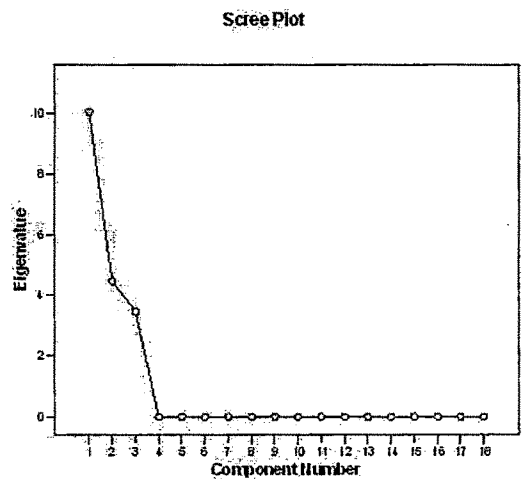

Fig. no. 3.9: Scree Plot For 2007 Summer

Table 3.11: Component matrix for 2008 Summer.

	Component		
	1	2	3
wndspd	-.908	.203	.366
MxT	.611	**.773**	.170
MnT	-.867	.479	.138
RF	-.880	-.316	-.354
RH	-.941	-.307	.143
VP	-.943	-.300	.144
CC	-.083	.100	-.991
LL	**.817**	.351	-.190
SO_2	.224	**.727**	**.516**
NO_X	**.839**	.543	-.047
RSPM	**.824**	-.661	.198
B.Inhaler	.653	**.791**	.310
B.Solids	.620	-.779	.093
B.Liquids	**.858**	-.259	-.126
B.Injecta	.642	-.763	.078
Inhaler.Devices	**.840**	-.399	**.542**
B.Others	.841	-.487	-.236
Anti.Others	.378	.732	-.567

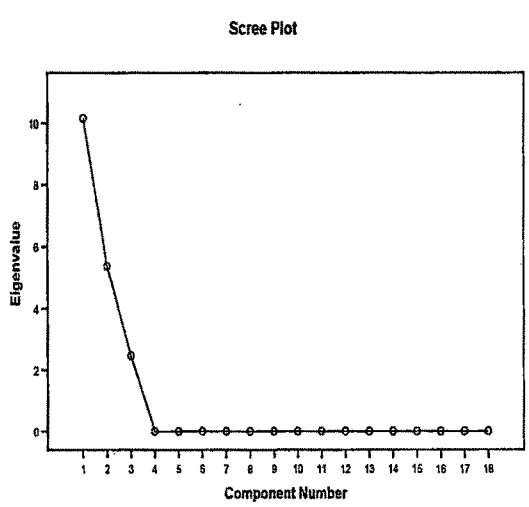

Fig. no. 3.10: Scree Plot For 2008 Summer

Table 3.12: Component matrix for 2009 Summer.

	Component		
	1	2	3
wndspd	**.912**	-.175	.371
MxT	-.197	**.965**	.173
MnT	**.970**	.125	.208
RF	.778	-.110	-.619
RH	.871	-.446	.205
VP	**.960**	-.229	-.162
CC	.594	.135	**.593**
LL	-.823	.169	**.542**
SO_2	.178	**.947**	-.269
NO_X	.187	.499	-.846
RSPM	**.989**	-.139	.046
InhlPrep	**.994**	.045	-.095
solids	-.978	-.202	-.039
liquids	**.981**	.022	-.191
Injecta	**.995**	-.100	-.029
Inhaler	.691	.626	.361
B.other	**.983**	-.173	-.059
AntiOther	-.832	-.517	-.202

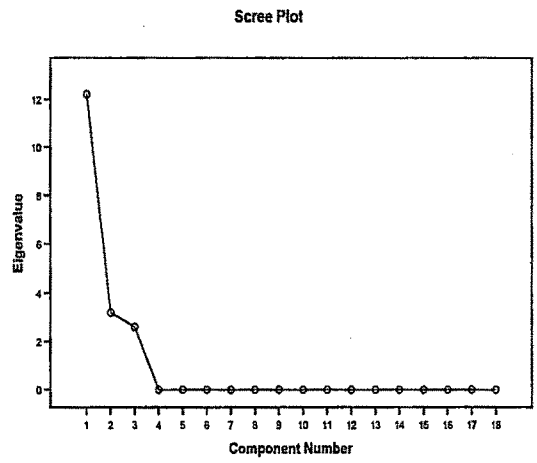

Fig. no. 3.11: Scree Plot For 2009 Summer

Table 3.13: Component matrix for 2010 Summer.

	Component	
	1	2
wndspd	**.969**	-.147
MxT	.363	-.795
MnT	.849	-.389
RF	.873	.468
RH	**.907**	.415
VP	**.997**	-.029
CC	**.990**	.105
LL	-.950	-.097
SO_2	.017	**.998**
NO_X	-.172	**.930**
RSPM	.787	.615
InhlPrep	**.993**	-.053
solids	-.907	.299
liquids	**.988**	-.054
Injecta	**.962**	-.126
Inhaler	**.994**	-.059
B.other	**.989**	-.124
AntiOther	**.977**	.152

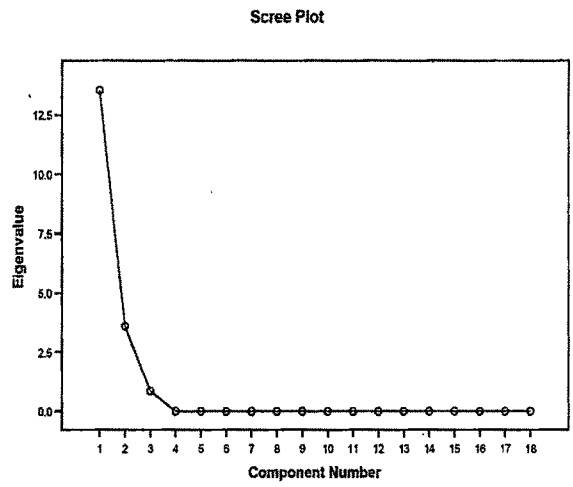

Fig. no. 3.12: Scree Plot For 2010 Summer

Table 3.14: Component Matrix For 2006 Monsoon

	Component		
	1	2	3
wndspd	-.923	.381	-.053
MxT	**.926**	-.084	-.683
MnT	-.919	-.385	.083
RF	-.824	.382	**.418**
RH	-.963	-.047	.264
VP	-.978	-.184	.099
CC	-.985	.089	.150
LL	**.978**	-.057	-.203
SO_2	**.922**	.388	-.005
NO_X	**.961**	.277	-.003
RSPM	**.962**	-.616	.199
B.InhlPrep	**.910**	-.260	**.426**
B.Solids	.461	**.775**	.146
B.Liquids	**.936**	-.505	.215
B.Injecta	.866	.576	**.473**
Inhaler.Device	**.921**	-.556	.129
B.others	.652	**.756**	.059
Anti.Others	-.309	.173	-.935

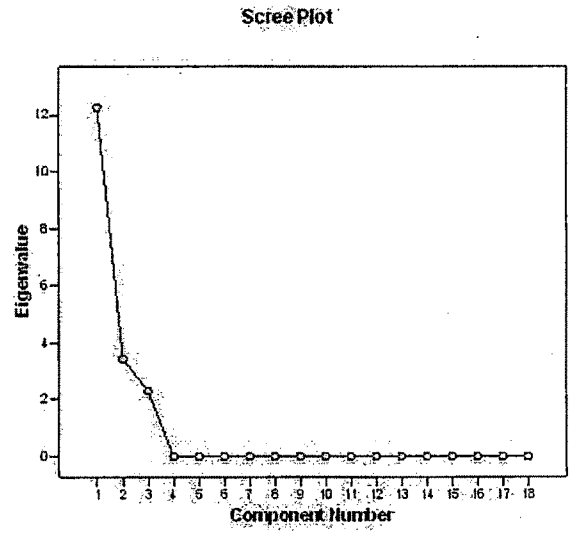

Fig. no. 3.13: Scree Plot For 2006 Monsoon

Table 3.15: Component Matrix For 2007 Monsoon

	Component		
	1	2	3
wndspd	**.966**	-.045	-.253
MxT	-.799	**.563**	-.210
MnT	**.935**	-.110	**.337**
RF	**.940**	.257	.224
RH	**.935**	-.284	.213
VP	**.941**	-.218	.261
CC	**.951**	-.271	.148
LL	-.931	.273	-.240
SO_2	.755	**.591**	.283
NO_X	.435	**.583**	.444
RSPM	**.925**	.365	.104
B.InhlPrep	-.840	-.018	**.342**
B.Solids	-.959	-.283	-.022
B.Liquids	-.931	.255	.261
B.Injecta	-.560	-.211	.801
Inhaler.Device	-.952	-.007	**.306**
B.others	-.934	.059	**.353**
Anti.Others	-.096	-.983	.159

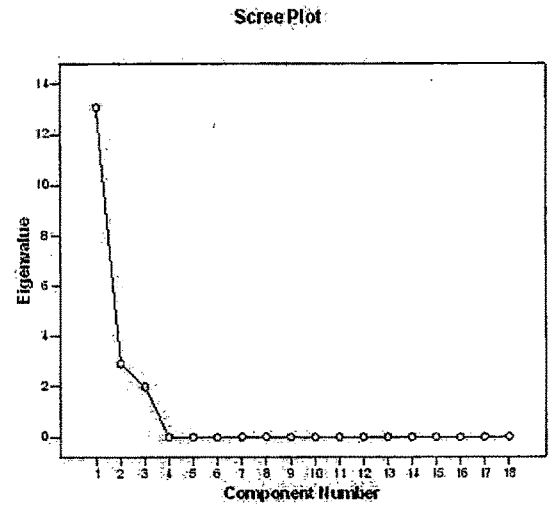

Fig.no. 3.14: Scree Plot For 2007 Monsoon

Table 3.16: Component matrix for 2008 Monsoon.

	Component		
	1	2	3
wndspd	-.994	-.023	-.106
MxT	**.913**	-.406	-.041
MnT	-.989	-.145	-.001
RF	-.938	.308	-.161
RH	-.923	.248	.295
VP	-.919	.243	.309
CC	-.862	-.426	-.275
LL	**.929**	-.262	-.262
SO_2	**.923**	-.688	-.059
NO_X	**.973**	-.118	-.198
RSPM	**.994**	.050	.096
B.Inhaler	.245	**.910**	-.335
B.Solids	**.968**	.310	.389
B.Liquids	-.228	**.967**	.116
B.Injecta	.663	.590	.460
Inhaler.Devices	.544	.375	.751
B.Others	.417	.684	-.598
Anti.Others	-.331	-.700	.633

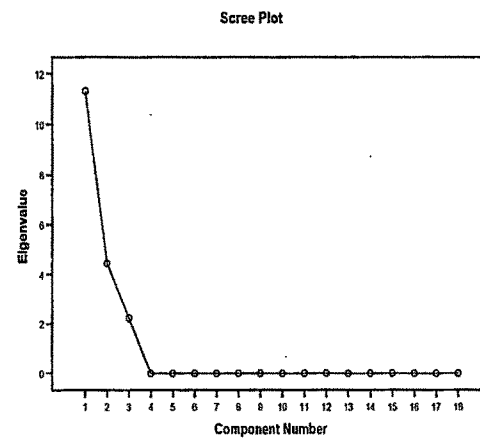

Fig.no. 3.15: Scree Plot For 2008 Monsoon

Table 3.17: Component matrix for 2009 Monsoon.

	Component		
	1	2	3
wndspd	.308	.951	.018
MxT	-.222	.955	-.198
MnT	.535	.732	-.422
RF	**.922**	-.369	.115
RH	**.965**	.070	-.251
VP	**.901**	.572	-.176
CC	-.587	.684	-.433
LL	-.539	.233	.809
SO_2	.669	.317	.672
NO_X	**.971**	.324	.369
RSPM	.697	.570	.436
InhlPrep	-.998	.027	.056
solids	**.993**	.032	-.110
liquids	-.999	-.026	.047
Injecta	-.998	.066	-.020
Inhaler	.721	-.680	-.133
B.other	-.998	.016	.053
AntiOther	.771	-.624	-.128

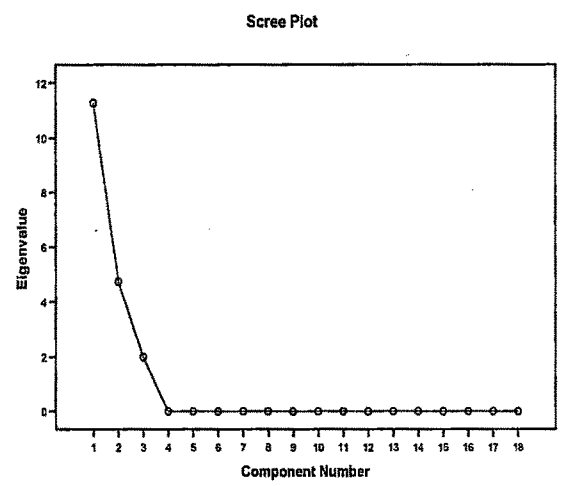

Fig.no. 3.16: Scree Plot For 2009 Monsoon

Table 3.18: Component matrix for 2010 Monsoon.

	Component	
	1	2
wndspd	.774	.144
MxT	-.612	-.732
MnT	-.175	-.983
RF	**.903**	-.429
RH	**.977**	.163
VP	**.997**	.062
CC	**.980**	-.175
LL	-.983	.129
SO_2	-.797	.467
NO_X	-.877	.414
RSPM	-.980	-.140
InhlPrep	**.904**	.403
solids	**.910**	-.370
liquids	**.904**	.367
Injecta	**.982**	-.099
Inhaler	.650	.748
B.other	.540	.842
AntiOther	**.937**	.348

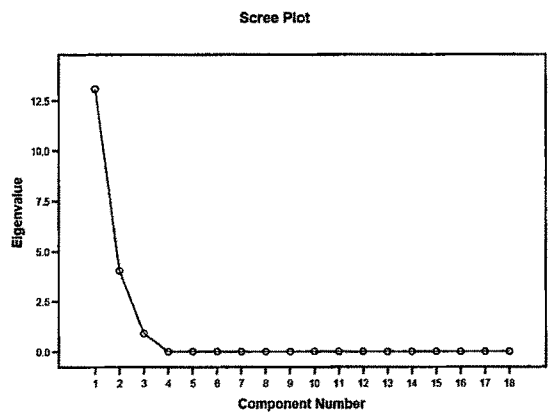

Fig.no. 3.17: Scree Plot For 2010 Monsoon

Table 3.19: Component Matrix For 2007 Winter

	Component		
	1	2	3
wndspd	-.222	**.916**	.334
MxT	**.935**	.676	.062
MnT	**.917**	-.428	-.387
RF	**.954**	.279	-.110
RH	.136	**.985**	.105
VP	**.940**	.224	**.494**
CC	-.181	**.923**	-.341
LL	.595	-.628	-.501
SO_2	**.982**	.181	-.057
NO_X	**.968**	.251	-.011
RSPM	**.990**	-.059	.127
B.InhlPrep	.401	-.905	.139
B.Solids	.163	.365	-.917
B.Liquids	**.994**	-.078	**.442**
B.Injecta	.556	-.197	-.807
Inhaler.Device	.332	**.909**	**.422**
B.others	-.233	-.862	**.450**
Anti.Others	.436	-.704	**.461**

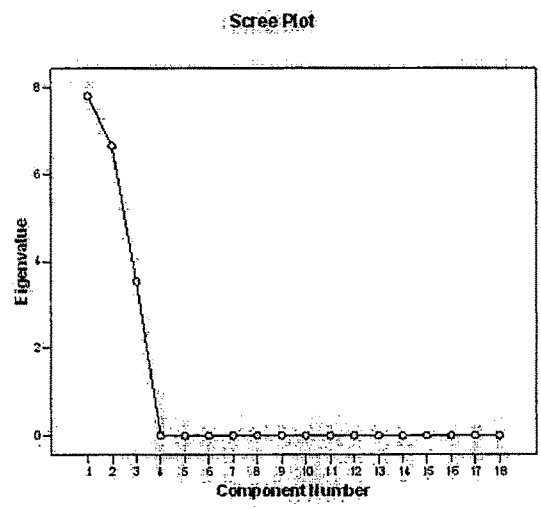

Fig. no. 3.18: Scree Plot For 2007 Winter

Table 3.20: Component matrix for 2008 Winter.

	Component	
	1	2
wndspd	**.989**	.458
MxT	**.996**	.094
MnT	.684	-.730
RF	**.974**	.228
RH	**.987**	-.162
VP	**.982**	-.189
CC	.104	**.995**
LL	.228	-.974
SO_2	-.235	**.972**
NO_X	**.987**	-.462
RSPM	.263	-.965
B.Inhaler	-.998	.058
B.Solids	**.978**	.479
B.Liquids	-.917	.398
B.Injecta	-.998	-.068
Inhaler.Devices	**.980**	.199
B.Others	**.914**	**.900**
Anti.Others	**.913**	.408

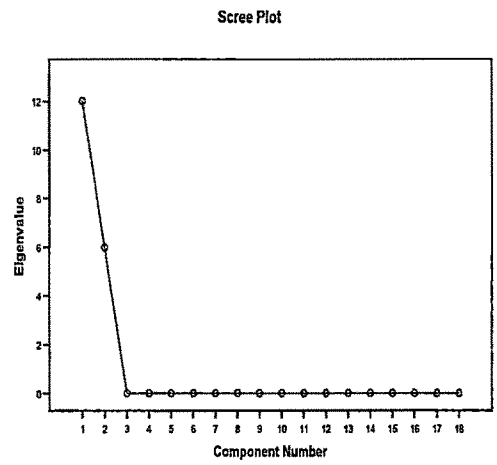

Fig. no. 3.19: Scree Plot For 2008 Winter

Table 3.21: Component matrix for 2009 Winter.

	Component		
	1	2	3
wndspd	.111	-.963	.243
MxT	-.185	-.399	.898
MnT	-.934	.343	-.101
RF	-.590	.521	.617
RH	-.904	-.348	-.247
VP	-.587	.529	.613
CC	-.846	.532	.030
LL	**.938**	-.058	.341
SO_2	**.951**	.138	.275
NO_X	.890	-.315	.329
RSPM	**.907**	.384	.174
InhlPrep	**.917**	.373	-.142
solids	-.952	.264	-.153
liquids	**.935**	.318	-.157
Injecta	**.912**	.390	-.131
Inhaler	-.358	-.933	-.030
B.other	**.927**	-.299	-.225
AntiOther	-.987	-.163	.013

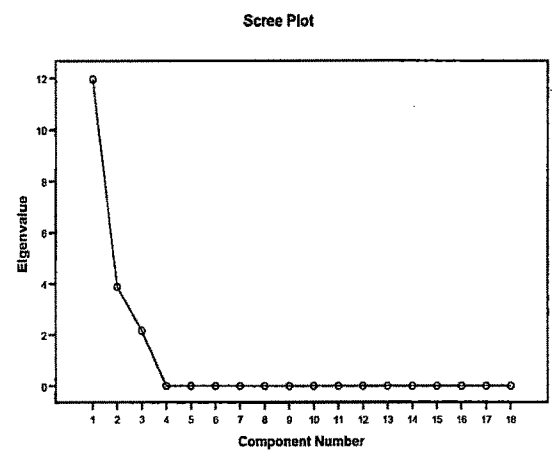

Fig. no. 3.19: Scree Plot For 2009 Winter

Table 3.22: Component matrix for 2010 Winter.

	Component		
	1	2	3
wndspd	.345	-.114	.932
MxT	.705	.513	.490
MnT	-.061	.983	-.174
RF	.427	.902	-.055
RH	**.975**	.098	.198
VP	**.959**	.257	-.122
CC	**.996**	.059	-.071
LL	-.753	-.589	-.294
SO_2	**.959**	-.278	-.056
NO_X	-.783	-.139	.607
RSPM	.626	.775	-.082
InhlPrep	**.972**	-.207	-.111
solids	-.958	.282	.055
liquids	**.973**	-.208	-.095
Injecta	**.979**	-.167	-.113
Inhaler	.526	-.680	.510
B.other	**.959**	-.280	-.044
AntiOther	.433	-.819	-.377

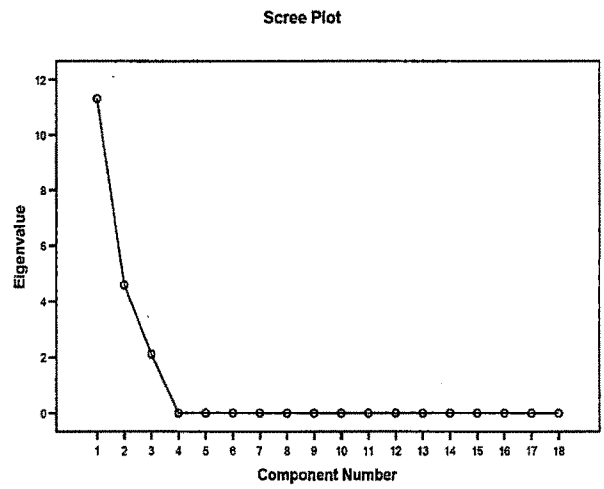

Fig. no. 3.20: Scree Plot For 2010 Winter

Table 3.23: Component Matrix of 2005 Summer For Specific Medicines.

Correlation With CC (In Yellow) and MxT. (In Green)

	Component		
	1	2	3
wndspd	.986	.146	-.077
MxT	.225	.896	.383
MnT	.851	.525	-.002
RF	.846	-.399	.355
RH	.920	-.391	-.003
VP	.993	-.101	-.058
CC	.775	-.373	**.509**
LL	-.900	.362	-.241
SO_2	-.889	-.457	-.017
NO_X	-.895	-.417	.157
RSPM	-.965	.034	.260
Inhaler	-.685	.185	**.505**

	Component		
	1	2	3
Wndspd	.981	.138	-.134
MxT	.218	**.959**	.179
MnT	.842	.523	-.136
RF	.861	-.305	.407
RH	.927	-.372	.054
VP	.993	-.099	-.063
CC	.794	-.248	**.555**
LL	-.912	.292	-.287
SO_2	-.881	-.461	.104
NO_X	-.884	-.386	.266
RSPM	-.959	.076	.274
B.other	-.418	**.996**	**.584**

	Component	
	1	2
wndspd	.993	-.096
MxT	.291	-.771
MnT	.885	-.457
RF	.821	.421
RH	.891	.438
VP	.983	.148
CC	.755	**.526**
LL	-.877	-.463
SO_2	-.919	.384
NO_X	-.919	.384
RSPM	-.957	-.036
AntiOther	-.813	**.557**

	Component	
	1	2
wndspd	.985	-.146
MxT	.241	-.860
MnT	.855	-.518
RF	.851	.431
RH	.917	.395
VP	.991	.101
CC	.785	.519
LL	-.903	-.386
SO_2	-.893	.449
NO_X	-.894	.424
RSPM	-.958	-.017
Injecta	-.945	.555

Table 3.24: Component Matrix of 2006 Summer For Specific Medicines.

Correlation With MxT. (In Green)

	Component	
	1	2
wndspd	.985	.170
MxT	-.467	**.728**
MnT	.866	.493
RF	.821	-.563
RH	.921	-.357
VP	.993	-.006
CC	.980	-.137
LL	-.931	.108
SO_2	-.970	.230
NO_X	-.867	-.430
RSPM	.967	.239
B.other	.480	**.727**

	Component		
	1	2	3
Wndspd	.967	.254	.011
MxT	-.497	**.513**	.614
MnT	.824	.556	.106
RF	.859	-.468	-.208
RH	.956	-.287	.063
VP	.995	.071	.066
CC	.995	-.063	.079
LL	-.956	.065	-.286
SO_2	-.980	.128	.151
NO_X	-.811	-.537	.234
RSPM	.937	.336	-.099
AntiOther	-.523	**.558**	-.644

Table 3.25: Component Matrix of 2007 Summer For Specific Medicines.

Correlation With CC (In Yellow), SO2 (In Orange), LL (In Blue) and RSPM (In Grey)

	Component		
	1	2	3
wndspd	.801	-.021	.433
MxT	-.567	-.818	.094
MnT	.768	-.020	.640
RF	.748	.594	-.295
RH	.851	.247	-.184
VP	.856	.232	.177
CC	.852	.492	-.178
LL	**.903**	-.390	.180
SO_2	-.435	-.648	.625
NO_X	.445	-.699	.560
RSPM	-.634	**.659**	.405
Inhaler	**.986**	**.667**	.009

	Component		
	1	2	3
Wndspd	.751	-.010	.525
MxT	-.543	.839	-.031
MnT	.699	.012	.515
RF	.796	.546	-.263
RH	.773	.204	-.104
VP	.741	.219	.256
CC	**.883**	.451	-.127
LL	-.930	-.348	.116
SO_2	-.472	.710	**.723**
NO_X	.360	-.663	.657
RSPM	-.647	.708	.283
B.other	**.821**	-.119	**.775**

Table 3.26: Component Matrix of 2008 Summer For Specific Medicines.

Correlation With Wndspd (In Yellow), SO2 (In Orange), LL (In Blue) and RSPM (In Grey)

	Component		
	1	2	3
wndspd	-.764	.633	-.120
MxT	.649	.516	.113
MnT	-.638	.744	.199
RF	-.949	-.135	.287
RH	-.982	.121	-.144
VP	-.982	.128	-.141
CC	-.083	-.344	.935
LL	.973	-.098	.208
SO_2	.519	.846	-.121
NO_X	.473	.152	.175
RSPM	.954	-.693	-.559
InhlPrep	.965	.498	-.053

	Component		
	1	2	3
Wndspd	.832	.846	.330
MxT	-.760	.650	.017
MnT	.747	.663	.055
RF	.941	-.189	-.281
RH	.975	-.078	.207
VP	.976	-.070	.207
CC	.109	-.066	-.992
LL	-.958	.117	-.261
SO_2	-.407	.843	.350
NO_X	-.926	.343	-.155
RSPM	-.587	-.748	.311
Inhaler	-.671	.836	.600

Table 3.27: Component Matrix of 2009 Summer For Specific Medicines.

Correlation With VP (In Teal) and RSPM (In Grey)

	Component		
	1	2	3
wndspd	.619	-.306	.249
MxT	-.357	.501	.788
MnT	.931	.021	.365
RF	.501	.454	-.392
RH	.627	-.369	-.064
VP	.988	.055	-.144
CC	.544	-.438	.715
LL	-.853	-.362	.376
SO_2	.027	.849	.527
NO_X	.124	.975	-.185
RSPM	.997	-.036	.066
InhlPrep	.976	.192	.105

	Component		
	1	2	3
Wndspd	.611	-.321	.258
MxT	-.363	.491	.792
MnT	.625	.003	.379
RF	.512	.451	-.371
RH	.624	-.379	-.057
VP	.991	.046	-.128
CC	.528	-.457	.716
LL	-.863	-.358	.357
SO_2	.029	.839	.543
NO_X	.138	.976	-.166
RSPM	.996	-.049	.081
Liquids	.971	.235	.040

b.)

Correlation With Wndspd (In Yellow), VP (In Teal), LL (In Blue), CC (In Yellow), RH (In D. Blue) and RSPM (In Grey)

	Component		
	1	2	3
wndspd	.725	-.285	.251
MxT	-.380	.468	.797
MnT	.726	.038	.376
RF	.491	.488	-.370
RH	.738	-.339	-.064
VP	.987	.089	-.131
CC	.549	-.441	.709
LL	-.846	-.397	.356
SO_2	-.004	.835	.551
NO_X	.096	.983	-.157
RSPM	.997	-.008	.077
Injecta	.996	.075	.057

	Component		
	1	2	3
Wndspd	.923	-.282	.262
MxT	-.394	.460	.796
MnT	.720	.040	.389
RF	.693	.495	-.355
RH	.941	-.334	-.053
VP	.989	.095	-.116
CC	.542	-.444	.714
LL	-.848	-.404	.341
SO_2	-.016	.830	.557
NO_X	.093	.985	-.148
RSPM	.996	-.003	.090
B.other	.998	.055	-.004

	Component		
	1	2	3
wndspd	.740	-.166	.297
MxT	-.296	.845	.447
MnT	.758	.174	.228
RF	.759	.164	-.630
RH	.723	-.380	.060
VP	.772	-.058	-.229
CC	.908	-.029	.794
LL	.914	-.091	.774
SO_2	.061	.998	.015
NO_X	.095	.739	-.667
RSPM	.800	-.029	-.004
Inhaler	.933	.573	.522

Table 3.28: Component Matrix of 2010 Summer For Specific Medicines.

Correlation With RF (In Pink), Wndspd (In Yellow), VP (In Teal), CC (In Yellow), RH (In D. Blue) and RSPM (In Grey)

	Component	
	1	2
wndspd	.751	-.249
MxT	.286	-.829
MnT	.796	-.477
RF	.916	.373
RH	.945	.317
VP	.989	-.135
CC	.997	-.001
LL	-.960	.005
SO_2	.124	.990
NO_X	-.067	.943
RSPM	.646	.528
InhlPrep	.979	-.158

	Component	
	1	2
wndspd	.950	-.249
MxT	.283	-.828
MnT	.798	-.478
RF	.716	.373
RH	.946	.316
VP	.989	-.135
CC	.997	-.001
LL	-.959	.004
SO_2	.124	.990
NO_X	-.068	.944
RSPM	.847	.528
liquids	.974	-.159

	Component	
	1	2
wndspd	.951	-.234
MxT	.288	-.819
MnT	.609	-.471
RF	.713	.383
RH	.942	.328
VP	.990	-.121
CC	.996	.013
LL	-.955	-.012
SO_2	.109	.993
NO_X	-.085	.946
RSPM	.940	.538
Injecta	.945	-.218

	Component	
	1	2
wndspd	.952	-.248
MxT	.288	-.829
MnT	.796	-.476
RF	.715	.374
RH	.945	.318
VP	.990	-.134
CC	.998	.000
LL	-.961	.004
SO_2	.123	.990
NO_X	-.067	.943
RSPM	.946	.529
Inhaler	.980	-.163

	Component	
	1	2
wndspd	.955	-.235
MxT	.300	-.825
MnT	.802	-.466
RF	.909	.387
RH	.940	.331
VP	.991	-.120
CC	.998	.014
LL	-.961	-.010
SO_2	.109	.992
NO_X	-.079	.942
RSPM	.938	.540
B.other	.972	-.214

	Component	
	1	2
wndspd	.945	-.292
MxT	.266	-.845
MnT	.761	-.508
RF	.925	.334
RH	.955	.276
VP	.984	-.178
CC	.998	-.045
LL	-.968	.049
SO_2	.169	.983
NO_X	-.014	.942
RSPM	.966	.491
AntiOther	.995	.003

Table 3.29: Component Matrix of 2005 Monsoon For Specific Medicines

Correlation With LL (In Blue)

	Component	
	1	2
wndspd	.998	.045
MxT	-.817	-.576
MnT	.977	-.190
RF	.902	-.423
RH	.965	-.115
VP	.954	.232
CC	.919	.326
LL	-.646	**.663**
SO_2	-.988	-.152
NO_X	-.899	-.351
RSPM	-.972	-.152
InhlPrep	-.782	**.612**

Table 3.30: Component Matrix For 2006 Monsoon For Specific Medicines

a. Correlation With RF (In Pink)

Correlation With RF (In Pink)

	Component	
	1	2
wndspd	.891	.374
MxT	-.819	-.198
MnT	.933	-.360
RF	.866	**.449**
RH	.993	.002
VP	.987	-.160
CC	.993	.117
LL	-.995	-.095
SO_2	-.923	.377
NO_X	-.958	.267
RSPM	-.703	-.580
B. Solids	-.461	**.484**

	Component	
	1	2
wndspd	.899	.287
MxT	-.804	-.353
MnT	.932	-.339
RF	.861	**.499**
RH	.990	.042
VP	.987	-.154
CC	.993	.112
LL	-.994	-.107
SO_2	-.924	.377
NO_X	-.960	.279
RSPM	-.715	-.438
Injecta	-.615	**.448**

	Component	
	1	2
wndspd	.887	.392
MxT	-.818	-.188
MnT	.937	-.350
RF	.862	**.451**
RH	.994	.009
VP	.988	-.148
CC	.992	.128
LL	-.994	-.104
SO_2	-.927	.364
NO_X	-.961	.252
RSPM	-.696	-.602
B.other	-.666	**.443**

b) Correlation With RSPM and MxT.

Correlation With RSPM (In Grey) and MxT. (In Green)

	Component	
	1	2
wndspd	.925	-.378
MxT	-.801	-.256
MnT	.907	.351
RF	.880	-.136
RH	.984	.152
VP	.975	.185
CC	.998	-.023
LL	-.996	-.029
SO_2	-.901	-.314
NO_X	-.944	-.217
RSPM	-.758	**.550**
InhlPrep	-.755	**.510**

	Component	
	1	2
wndspd	.930	-.355
MxT	-.815	-.099
MnT	.896	.421
RF	.895	-.249
RH	.985	.137
VP	.969	.231
CC	1.000	-.020
LL	-.998	-.021
SO_2	-.888	-.406
NO_X	-.933	-.299
RSPM	-.766	**.522**
liquids	-.830	**.516**

	Component	
	1	2
wndspd	.930	-.345
MxT	-.820	-.066
MnT	.894	.432
RF	.899	-.268
RH	.986	.133
VP	.967	.240
CC	1.000	-.018
LL	-.998	-.020
SO_2	-.885	-.422
NO_X	-.931	-.314
RSPM	-.766	**.508**
Inhaler	-.830	**.535**

	Component		
	1	2	3
Wndspd	.913	.292	-.285
MxT	-.820	**.519**	.243
MnT	.914	-.078	.399
RF	.884	-.164	-.438
RH	.990	-.136	.026
VP	.978	-.021	.208
CC	.998	.016	-.065
LL	-.998	.041	.052
SO_2	-.904	.005	-.427
NO_X	-.945	-.037	-.324
RSPM	-.737	-.482	.473
AntiOther	.172	**.574**	.145

Table 3.31: Component Matrix For 2007 Monsoon For Specific Medicine

Correlation With MxT. (In Green), RF (In Pink), NOx (In Brown) and RSPM (In Grey)

	Component	
	1	2
wndspd	.911	-.111
MxT	-.850	.482
MnT	.903	-.011
RF	.981	.310
RH	.970	-.213
VP	.901	-.136
CC	.915	-.218
LL	-.911	.195
SO_2	.762	.648
NO_X	.463	.876
RSPM	.910	.382
liquids	.986	.815

Table 3.32: Component Matrix For 2008 Monsoon For Specific Medicine

Correlation With LL (In Blue), Wndspd (In Dark Yellow), SO2 (In Orange) and RSPM (In Grey)

	Component	
	1	2
wndspd	.871	.168
MxT	-.964	.265
MnT	.755	.289
RF	.761	-.168
RH	.766	-.104
VP	.763	-.100
CC	.771	.545
LL	.972	.118
SO_2	-.820	.572
NO_X	-.990	-.030
RSPM	.968	-.195
InhlPrep	.927	-.940

	Component	
	1	2
wndspd	.979	.201
MxT	-.961	.222
MnT	.760	.220
RF	.768	-.012
RH	.753	-.274
VP	.750	-.280
CC	.790	.595
LL	-.961	.262
SO_2	.912	.463
NO_X	-.984	.108
RSPM	-.976	-.214
Inhaler	.974	-.839

Table 3.33: Component Matrix For 2009 Monsoon For Specific Medicine

Correlation With LL (In Blue), Wndspd (In Dark Yellow), RH (In D. Blue), VP (In Teal), NOx (In Brown), CC (In Yellow), SO2 (In Orange) and RSPM (In Grey)

	Component		
	1	2	3
wndspd	.629	.768	.121
MxT	.124	.992	-.033
MnT	.738	.564	-.369
RF	.734	-.678	-.043
RH	.912	-.224	-.345
VP	.942	.282	-.180
CC	-.326	.909	-.262
LL	-.376	.260	.890
SO_2	.773	-.055	.632
NO_X	.948	-.065	.313
RSPM	.777	.210	.433
solids	.932	-.294	-.214

	Component		
	1	2	3
Wndspd	.594	.804	.039
MxT	.077	.989	-.125
MnT	.705	.561	-.433
RF	.764	-.645	.004
RH	.716	-.213	-.340
VP	.725	.307	-.223
CC	.972	.865	-.337
LL	.974	.323	.869
SO_2	.784	.039	.620
NO_X	-.954	.007	.299
RSPM	.772	.288	.395
Inhaler	.956	-.857	-.239

	Component		
	1	2	3
wndspd	.917	.778	.117
MxT	.108	.994	-.031
MnT	.726	.577	-.375
RF	.744	-.666	-.052
RH	.912	-.208	-.354
VP	.736	.298	-.188
CC	-.343	.904	-.256
LL	-.371	.252	.894
SO_2	.780	-.044	.624
NO_X	.752	-.051	.303
RSPM	.678	.223	.425
B.other	.926	.334	.176

Table 3.34: Component Matrix For 2010 Monsoon For Specific Medicine

Correlation With LL (In Blue), Wndspd (In Dark Yellow), SO2 (In Orange) and RSPM (In Grey)

	Component	
	1	2
wndspd	.714	-.208
MxT	-.554	.795
MnT	-.080	.996
RF	.941	.337
RH	.963	-.261
VP	.981	-.159
CC	.997	.075
LL	-.997	-.029
SO_2	-.863	-.379
NO_X	-.928	-.321
RSPM	-.968	.239
solids	.928	.282

	Component	
	1	2
wndspd	.715	-.177
MxT	-.635	.721
MnT	-.178	.980
RF	.902	.423
RH	.985	-.162
VP	.989	-.070
CC	.985	.173
LL	-.991	-.129
SO_2	-.829	-.480
NO_X	-.896	-.420
RSPM	-.988	.139
AntiOther	.936	-.351

Table 3.35: Component Matrix For 2006 Winter For Specific Medicine

Correlation With RSPM (In Grey)

	Component		
	1	2	3
wndspd	.924	.319	-.213
MxT	-.629	.205	-.750
MnT	-.727	-.656	.203
RH	.049	.464	.884
VP	-.988	.051	.148
CC	-.730	.606	.316
LL	.872	-.241	.427
SO_2	.998	.056	-.022
NO_X	.882	.382	-.276
RSPM	-.427	**.976**	-.224
InhlPrep	.019	**.988**	.153

	Component		
	1	2	3
Wndspd	-.903	.391	-.177
MxT	.639	.237	-.732
MnT	.687	-.714	.137
RH	-.021	.383	.924
VP	.989	-.021	.147
CC	.765	.531	.366
LL	-.884	-.228	.408
SO_2	-.993	.116	-.011
NO_X	-.858	.457	-.234
RSPM	.478	**.966**	-.145
Injecta	.214	**.969**	.126

Correlation With RSPM (In Grey)

	Component		
	1	2	3
wndspd	.913	.347	-.214
MxT	-.632	.172	-.756
MnT	-.704	-.678	.211
RH	.029	.480	.877
VP	-.989	.020	.144
CC	-.752	.586	.303
LL	.877	-.204	.434
SO_2	.996	.090	-.019
NO_X	.870	.408	-.278
RSPM	-.456	**.957**	-.240
solids	-.117	**.980**	.158

Table 3.36: Component Matrix For 2007 Winter For Specific Medicine

Correlation With CC (In Yellow)

	Component		
	1	2	3
wndspd	-.210	.978	-.012
MxT	.758	.651	.048
MnT	.832	-.538	.131
RF	.974	.217	.063
RH	.176	.968	.178
VP	.786	.351	-.510
CC	-.089	.778	**.622**
LL	.616	-.760	.208
SO_2	.990	.140	-.020
NO_X	.974	.221	-.041
RSPM	.963	-.033	-.267
Injecta	.637	-.442	**.631**

	Component		
	1	2	3
Wndspd	-.081	.983	-.164
MxT	.835	.550	-.021
MnT	.753	-.613	.240
RF	.993	.100	.066
RH	.298	.954	.039
VP	.833	.168	-.527
CC	.003	.868	.996
LL	.508	-.791	.341
SO_2	1.000	.009	-.004
NO_X	.995	.088	-.037
RSPM	.955	-.194	-.223
Solids	.280	.173	.944

Table 3.37: Component Matrix For 2008 Winter For Specific Medicine

Correlation With LL (In Blue), SO2 (In Orange) and RSPM (In Grey)

	Component		
	1	2	3
wndspd	-.697	.509	.505
MxT	-.688	-.429	.585
MnT	-.887	.025	-.460
RF	-.838	.398	.373
RH	.600	.723	.343
VP	-.950	.224	-.216
CC	-.225	.967	-.116
LL	.911	-.285	.297
SO_2	.749	.312	.427
NO_X	.738	-.072	.340
RSPM	.994	.165	-.417
InhlPrep	.992	.412	-.451

	Component		
	1	2	3
Wndspd	.954	.560	.344
MxT	.607	-.278	.744
MnT	.690	-.254	-.378
RF	.679	.393	.268
RH	-.495	.868	.027
VP	.677	.008	-.215
CC	.365	.826	-.430
LL	-.948	-.041	.314
SO_2	.903	.550	.231
NO_X	-.945	.174	.278
RSPM	-.852	.120	-.509
Inhaler	.974	.177	.093

Table 3.38: Component Matrix For 2009 Winter For Specific Medicine

Correlation With VP (In Teal) and RSPM (In Grey)

	Component		
	1	2	3
wndspd	.244	-.884	.398
MxT	-.080	-.246	.966
MnT	-.974	.212	-.083
RF	-.612	.256	.563
RH	-.867	-.486	-.109
VP	.911	.563	.557
CC	-.903	.331	.004
LL	.757	.110	.269
SO_2	.742	.291	.169
NO_X	.741	-.148	.306
RSPM	.961	.508	.030
InhlPrep	.953	.541	-.279

	Component		
	1	2	3
Wndspd	.250	-.871	.423
MxT	-.080	-.220	.972
MnT	-.975	.203	-.091
RF	-.618	.567	.545
RH	-.863	-.495	-.097
VP	.916	.574	.540
CC	-.906	.424	-.010
LL	.655	.125	.268
SO_2	.639	.303	.163
NO_X	.641	-.132	.312
RSPM	.957	.515	.018
Liquids	.975	.384	-.294

b.)

Correlation With LL (In Blue), Wndspd (In Dark Yellow), RH (In D. Blue), VP (In Teal), CC (In Yellow) and RSPM (In Grey)

	Component		
	1	2	3
wndspd	.243	-.886	.396
MxT	-.079	-.248	.966
MnT	-.973	.215	-.081
RF	-.610	.356	.565
RH	-.869	-.483	-.108
VP	.908	.564	.559
CC	-.902	.333	.007
LL	.758	.108	.268
SO_2	.743	.289	.168
NO_X	.741	-.151	.304
RSPM	.962	.506	.030
Injecta	.947	.557	-.271

	Component		
	1	2	3
Wndspd	.939	-.608	.718
MxT	-.054	.173	.983
MnT	-.991	.059	-.121
RF	-.671	.675	.308
RH	.908	-.572	.141
VP	.970	.679	.299
CC	-.945	.300	-.135
LL	.738	.309	.156
SO_2	.603	.429	-.009
NO_X	.650	.089	.298
RSPM	.900	.558	-.221
B.other	.962	-.214	-.168

	Component		
	1	2	3
wndspd	-.296	.881	.369
MxT	.030	.268	.963
MnT	.984	-.173	-.040
RF	.611	-.519	.598
RH	.850	.519	-.084
VP	.610	-.526	.593
CC	.918	-.392	.050
LL	.962	-.145	.233
SO_2	-.935	-.327	.137
NO_X	-.958	.114	.265
RSPM	-.840	-.543	.006
Inhaler	.994	-.969	.152

Table 3.39: Component Matrix For 2010 Winter For Specific Medicine

Correlation With RF (In Pink), Wndspd (In Dark Yellow), RH (In D. Blue), VP (In Teal), NOx (In Brown), CC (In Yellow) and RSPM (In Grey)

	Component		
	1	2	3
wndspd	.312	-.310	.898
MxT	.851	.197	.487
MnT	.272	.958	-.092
RF	.907	.707	-.009
RH	.956	-.255	.147
VP	.985	-.070	-.158
CC	.954	-.273	-.125
LL	-.916	-.271	-.295
SO_2	.805	-.578	-.134
NO_X	-.766	.076	.639
RSPM	.850	.524	-.057
InhlPrep	.940	-.510	-.184

	Component		
	1	2	3
Wndspd	.914	-.317	.895
MxT	.852	.194	.487
MnT	.271	.959	-.086
RF	.707	.708	-.005
RH	.956	-.255	.143
VP	.985	-.069	-.160
CC	.954	-.271	-.129
LL	-.917	-.270	-.295
SO_2	.805	-.576	-.140
NO_X	-.764	.070	.641
RSPM	.850	.525	-.055
Liquids	.941	-.512	-.174

	Component		
	1	2	3
wndspd	.910	-.318	.896
MxT	.801	.191	.489
MnT	.276	.957	-.085
RF	.710	.704	-.003
RH	.955	-.260	.146
VP	.985	-.073	-.158
CC	.953	-.276	-.126
LL	-.917	-.266	-.297
SO_2	.803	-.580	-.137
NO_X	-.766	.074	.639
RSPM	.952	.521	-.053
Injecta	.959	-.477	-.186

	Component		
	1	2	3
Wndspd	.941	.576	.743
MxT	.381	-.018	.473
MnT	.307	-.933	.186
RF	.735	-.658	.164
RH	.950	.312	.007
VP	.973	.044	-.229
CC	.934	.247	-.257
LL	-.940	.145	-.309
SO_2	.773	.530	-.349
NO_X	-.730	.103	.675
RSPM	.968	-.494	.054
Inhaler	.961	.957	.126

b.)

Correlation With Wndspd (In Dark Yellow), RH (In D. Blue), VP (In Teal), CC (In Yellow) and RSPM (In Grey)

	Component		
	1	2	3
wndspd	.923	-.326	.888
MxT	.854	.194	.483
MnT	.263	.962	-.075
RF	.701	.713	.000
RH	.959	-.250	.133
VP	.984	-.059	-.168
CC	.955	-.263	-.139
LL	-.917	-.272	-.292
SO_2	.809	-.568	-.153
NO_X	-.760	.056	.647
RSPM	.945	.532	-.054
B.other	.908	-.572	-.142

	Component		
	1	2	3
Wndspd	.906	.132	.943
MxT	.876	-.223	.427
MnT	.351	-.886	-.303
RF	.765	-.622	-.168
RH	.934	.300	.195
VP	.971	.191	-.143
CC	.924	.377	-.066
LL	-.943	.247	-.223
SO_2	.749	.662	-.007
NO_X	-.741	-.282	.610
RSPM	.990	-.420	-.176
AntiOther	.931	.965	-.260

Table: 3.40 Representation of Seasonal Medicinal sale with the Triggering factors

Parameters	Seasons		
	Summer	Monsoon	Winter
Wndspd - ↓			
MxT.			
MnT.			
Rain Fall			
Relative Humidity			
Vapour Pressure			
Cloud Cover			
H. Lowest Layer			
SO_2			
NO_X			
RSPM			

Key:- **Medicine** - B. inha. preparation; B. Dilator Solids; B. Dilator Liquids; B. injecta; Inhalor Devices; B. others; Anti. Others

2005 -
2006 -
2007 -
2008 -
2009 -
2010 -

3.4 DISCUSSION

Changes in certain environmental risk factors and exposures contribute to increased trends in the respiratory diseases, but little information is available relating specific risk factors to longitudinal trends, geographic variability, or high-risk populations (Evalyn *et al.,* 1999). At the national level, there is good evidence that over the last decade, increased sales of respiratory illness drugs were associated with a decline in rates of hospital admission for the disease. The level of drug sales and their trends will reflect not only the burden of respiratory illness but also the proportion of patients being treated (Gupta *et al.,* 2006). Several hypotheses have been proposed to account for the increase, but there is still controversy, and the issue remains unresolved. The present work is an attempt to find the co-relation between the meteorological factors and the respiratory illness medical sale for Vadodara city, an indirect evidence for the prevalence of respiratory illness burden in Vadodara city.

When observed on annual basis in SPSS with all the meteorological factors, pollutants and total respiratory illness medical sale all the three pollutants had strong participatory role and showed a direct correlation with the altered medical sale. Individual meteorological factors also played an important participatory role.

In the treatment of respiratory illness, inhaled medications are generally preferred, which act directly on the airway surface and airway muscles. Moreover, absorption of inhaled medications into the rest of the body is minimal. Bronchodilators open up the air passages making breathing easier. Narrowing of the air passages causes wheezing, commonly seen in people with asthma and chronic obstructive pulmonary disease. Inhaled bronchodilator medications can more quickly open narrowed air passages since they are inhaled directly into the lungs (Nelson *et al.,* 1998; Wallin *et al.,* 1999; Li *et al.,* 1999 and Kips and Pauwels, 2001). The direct costs of treating respiratory illness and indirect costs are substantial (Schramm *et al.,* 2003; Reed *et al.,* 2004 and Thomas *et al.,* 2005).

Annual ccomponent matrix analysis was carried out for the individual medical sale as one group and the meteorological parameters and pollutants as another group; it exposed thee fact that in 2005 (**Table 3.2**) increase in **RH** was associated with increase sale of B. Solids and B. Liquids. However, the principal component analysis when carried out for individual medical sale as one group and the rest of the factors as another group for 2006 (**Table 3.3**), it was established that **RH** was responsible for increasing sale of inhaler devices, B. Liquids and B. Inhalant preparations. At the same time the increasing concentration of SO_2 was responsible for the increasing sale of B. Injecta, and that the increasing **MxT.** was responsible for the increasing sale of B. others. Principal component analysis when carried out for the year 2007 (**Table 3.4**), it was found that increase in **RH** was responsible increasing sale of B. Solids and that the increasing concentration of SO_2 was responsible for the increasing sale of B. Others. Patankar *et al.,* (2011) in their investigation have proved the link between air pollution and health impacts for Mumbai, and estimate the monetary burden of these impacts.

When annual component matrix analysis was carried out for the individual medical sale as one group and the meteorological parameters and pollutants as another group; it exposed the fact that in **2008 (Table 3.5)**, it was observed that **SO2** and sale of B. Inhalant preparations, inhaler devices and B. Others, **CC** and B. Solids as well as B. Injecta and **RSPM** are positively correlated; wherein the increase in concentration in any of the meteorological factor as well as the pollutant is increasing the sale of the respective medicine.

Principal component analysis for 2009 (**Table 3.6**) with individual medicine sale revealed that **RH** and **CC** was positively correlated with the sale of B. Inhalant preparations, B. Liquids and B. others. Also, increase in concentration of **NOx** was responsible for the increasing sale of B. Solids and that increasing **MxT** for the increasing sale of B. Injecta. Similarly in 2010 (**Table 3.7**), it was observed that increasing concentration of SO_2 was responsible for the increasing sale of B. Others. Similarly there was a positive correlation between **NOx** and B. Solids; **CC** and Anti- asthmatics others; **VP** and Anti asthmatics others

In the present study also the increase in the medical sale is dependent on distinct meteorological factors as well as pollutants and that each factor acts as trigger for the increase in the specific medical sale and thus proves the direct link between the triggering factors and respiratory illness.

To have better understanding whether there is any seasonal variation in the triggering factors for the medical sale seasonal extraction was also carried out. 2005 (**Table 3.8** and **3.23**) **summer** component matrix analysis revealed that there was a positive correlation with the sale of inhaler devices, B. Others, B. Injecta and anti – asthmatics others and **CC.** At the same time increasing **MxT**. was responsible for the increasing sale of B. Others. 2006 (**Table 3.9** and **3.24**) summer on the other hand revealed that when **MxT**. was increasing sale of B. Others and Anti – asthmatics others was also increasing. And 2007 summer (**Table 3.10** and **3.25**), disclosed the fact that sale of Inhalers devices was increasing with the increase in **LL** and **RSPM** level in the atmosphere. Also, the sale of B. Others were increasing with the increase in **CC** and SO_2 level in the atmosphere. In 2008, as observed in **Table 3.11** and **3.26**, sale of B. Inhalant preparation was increasing with the increasing level of **LL** and **RSPM** in the atmosphere. Similarly, sale of inhaler devices was increasing with the increasing **wndspd** and SO_2. In 2009 (**Table 3.12** and **3.27**), it revealed that increasing **VP** and **RSPM** was responsible for the sale of B. Inhalant preparation, B. Liquids, B. Injecta and B. Others. At the same time, sale of inhaler devices was increasing due to increasing level of **CC** and **LL** and that of B. Others was increasing due to increasing **RH** and **wndspd**. For 2010 (**Table 3.13** and **3.28**), increasing concentration of **RF, RH, VP** and **CC** was responsible for the increasing sale of B. Inhalant preparations. On the other hand the sale of B. Liquids was increasing due to increasing concentration of **VP, CC, Wndspd** and **RH**. At the same time the increasing concentration of **wndspd, RH, VP, CC** and **RSPM** was increasing the sale of B. Inecta, Inhaler devices, B.others and Anti-asthmatics others.

Component matrix analysis was also carried out for the individual medical sale as one group and the meteorological parameters and pollutants as another group for monsoon season. In 2005 monsoon (**Table no. 3.29**), it make known that sale of B. Inhalant preparations was increasing

with the increasing level of **LL** in the atmosphere. During monsoon 2006 (**Table 3.14** and **3.30**) in **RF** was increasing the sale of B. Solids, B. Injecta and B. Others. At the same time increase in **RSPM** concentration was responsible for the increasing sale of B. Inhalant preparation, B. Liquids and inhaler devices. Increase in **max. Temp** was increasing the sale of Anti – asthmatics others. Data analysis for 2007 (**Table 3.15** and **3.31**) monsoon revealed that increase in **NO_x, RSPM and MxT and RF** was responsible for the increase in sale of B. Liquids. Increase in **NO_x and RSPM** in combination was also increasing the sale of inhaler devices. Increase in **SO_2 and RSPM** was increasing the sale of B. Others. Rising **min temp** was increasing the sale of B. Injecta. Hence, it gave a positive correlation between the meteorological parameters, pollution and medication sale. In 2008 (**Table 3.16** and **3.32**), sale of B. Inhalant preparation was increasing with the increasing level of LL and RSPM in the atmosphere. Similarly, sale of inhaler devices was increasing with the increasing wndspd and SO2. For 2009 (**Table 3.17** and **3.33**), increasing **RH, VP** and **NOx** was responsible for the sale of B. Solids. At the same time, sale of inhaler devices was increasing due to increasing level of **CC** and **LL** and that of B. Others was increasing due to increasing **RH** and **wndspd**. In 2010 (**Table 3.18** and **3.34**), it was found that sale of B. Solids and Anti – asthmatic others was increasing due to increasing concentration of **RF, RH, VP** and **CC**.

Winter season again showed a very different analysis and when component matrix analysis was carried out for the individual medical sale as one group and the meteorological parameters and pollutants as another group, it revealed that for 2005, decrease **in wndspd** was increasing the sale of B. Others. During 2006 (**Table 3.35**) winter increase in sale of B. Inhalant preparations, B. Injecta and B. Solids was due to the increasing level of **RSPM** in the atmosphere to give a positive correlation. At the same time sale of inhaler devices was decreasing to give a negative correlation. When component matrix analysis was carried out for the individual medical sale as one group and the meteorological parameters and pollutants as another group for 2007 (**Table 3.19** and **3.36**), it revealed that increase in **CC** level was increasing the sale of B. Solids and B. Injecta. In 2008 (**Table 3.20** and **3.37**), sale of B. Inhalant preparation was increasing with the increasing level of **LL** and **RSPM** in the atmosphere. Similarly, sale of inhaler devices was increasing with the increasing wndspd and **SO_2**. Analysis for 2009 (**Table 3.21** and **3.38**)

revealed that increasing **VP** and **RSPM** was responsible for the sale of B. Inhalant preparation, B. Liquids, B. Injecta and B. Others. At the same time, sale of inhaler devices was increasing due to increasing level of **CC** and **LL** and that of B. Others was increasing due to increasing **RH** and **wndspd**. Whereas in 2010 (**Table 3.22** and **3.39**), it was found that sale of B. Inhalant preparations was increasing due to increasing concentration of **RF, RH, VP** and **CC**. Similarly the sale of B. Liquids was increasing due to increasing concentration of **VP, CC, Wndspd** and **RH**. At the same time the increasing concentration of **wndspd, RH, VP, CC** and **RSPM** was increasing the sale of B. Inecta, Inhaler devices, B.others and Anti-asthmatics others.

Our results are in agreement with the recent work of Schwela (2000), Chauhan and Johnston (2003) and Watts (2006) on the human health effects of current air pollution trends in urban areas are reviewed and summarized that the association of the SO_2 exposure increases the mortality and morbidity. van der Zee *et al.,* (1999) in their studies have reported that proper use of the medication prevents the exacerbations of the respiratory illness.

In the present study the pollutants as well as the meteorological factors were found to be directly showing the co-relation with the medical sale for respiratory illness. The results of this study confirm those of some earlier studies (Roemer *et al.,* 2000), and suggest that aggravation of respiratory illness is related to daily variations in air quality. The increase in medication use with altered meteorological factors and pollution concentration thus can prove to be a marker for increasing respiratory illness. Given the increased prevalence of these diseases, effective predictions would benefit a large segment of the population. As the link between triggering factors in the form of meteorology as well as the pollutants thus is an indirect evidence to prove the prevailing condition of the illness and also indicate that it may be appropriate to examine severe respiratory illness symptoms separately.

3.5 CONCLUSION:

The aim of the present study was to find the correlation and interdenpendence between the meteorological factors and pollution level concentration I the city with the sale of respiratory illness medicines in the city. In total 18 parameters (8 meteorological + 3 polutants + 7 medicines sales) were applied on SPSS 12.0 to find the correlation between each of them. It was found that pollutants as well as the meteorological factors were found to be directly showing the co-relation with the medical sale for respiratory illness. Also, it was observed that as and how the years were passing by the role of meteorological parameters in the sale of medicines was increasing. Hence, our next aim was find the correlation between the asthma exacerbations and the environmental factors in the vadodara city to identify the season in particular affecting the asthma exacerbations as well as the role of gender and age in the exacerbations trend.