```
 1 C:\Users\DELL\anaconda3\python.exe E:/Golder_Folder/
   PycharmProjects2/MichaelProject/main.py
 2 Importing Data...
 3 Data Import Done!!
 4 _____Exploring
   Started_____
 5 Describing Data...
 6 Describing Done!!
 7 Checking Null Values..
 8 well_code                  0
 9 date_sampling              0
10 quarter                    0
11 type_analyzing             0
12 date_analyzing             0
13 laboratory                 5
14 number_analyzing          83
15 na                         1
16 k                          1
17 ca2                        1
18 mg2                        1
19 fe3                        4
20 fe2                       15
21 al3                        1
22 nh4                      924
23 cl                         1
24 so4                        1
25 hco3                       1
26 co3                        1
27 no2                       29
28 hardness_general           1
29 no3                        9
30 po4                     2139
31 hardness_temporal          1
32 hardness_permanent         1
33 ph                         1
34 eh                      2139
35 co2_free                   1
36 co2_depend                 1
37 co2_infiltrate             2
38 oxygen                  2139
39 lienhe                  2139
```

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40 conductivity          2139
41 oxygen_dissolve       2139
42 sio2                     2
43 color                    1
44 smell                    1
45 tatse                    1
46 tds105                   1
47 tds180                2139
48 dtype: int64
49 Checking Null Done!!
50 Checking Data info...
51 <class 'pandas.core.frame.DataFrame'>
52 RangeIndex: 2139 entries, 0 to 2138
53 Data columns (total 40 columns):
54  #   Column            Non-Null Count  Dtype

55 ---  ------            --------------  -----

56  0   well_code         2139 non-null   object

57  1   date_sampling     2139 non-null   datetime64[
    ns]
58  2   quarter           2139 non-null   object

59  3   type_analyzing    2139 non-null   int64

60  4   date_analyzing    2139 non-null   datetime64[
    ns]
61  5   laboratory        2134 non-null   object

62  6   number_analyzing  2056 non-null   float64

63  7   na                2138 non-null   float64

64  8   k                 2138 non-null   float64

65  9   ca2               2138 non-null   float64

66  10  mg2               2138 non-null   float64

67  11  fe3               2135 non-null   float64
```

67

68	12	fe2	2124 non-null	float64
69	13	al3	2138 non-null	float64
70	14	nh4	1215 non-null	float64
71	15	cl	2138 non-null	float64
72	16	so4	2138 non-null	float64
73	17	hco3	2138 non-null	float64
74	18	co3	2138 non-null	float64
75	19	no2	2110 non-null	float64
76	20	hardness_general	2138 non-null	float64
77	21	no3	2130 non-null	float64
78	22	po4	0 non-null	float64
79	23	hardness_temporal	2138 non-null	float64
80	24	hardness_permanent	2138 non-null	float64
81	25	ph	2138 non-null	float64
82	26	eh	0 non-null	float64
83	27	co2_free	2138 non-null	float64
84	28	co2_depend	2138 non-null	float64
85	29	co2_infiltrate	2137 non-null	float64
86	30	oxygen	0 non-null	float64
87	31	lienhe	0 non-null	float64

88	32	conductivity	0 non-null	float64
89	33	oxygen_dissolve	0 non-null	float64
90	34	sio2	2137 non-null	float64
91	35	color	2138 non-null	object
92	36	smell	2138 non-null	object
93	37	tatse	2138 non-null	object
94	38	tds105	2138 non-null	float64
95	39	tds180	0 non-null	float64

```
 96 dtypes: datetime64[ns](2), float64(31), int64(1),
    object(6)
 97 memory usage: 668.6+ KB
 98 Checking Info Done!!
 99 _____Exploring
    Done_____
100 _____Processing
    Started_____
101 Missing Values Preprocessing initiated...
102 Done!!
103 Transforming features initiated...
104 Done!!
105 Creating Water Quality index...
106 Done!!
107 _____Processing
    Done_____
108 Removing Correlated Columns...
109 Done!!
110 Encoding Labels...
111 Done!!
112 Model Name: RF, Fold Number: 0
113 Elapsed time:  0.19869089126586914
114 Model Name: XGB, Fold Number: 0
115 Elapsed time:  0.09660911560058594
116 Model Name: LGBM, Fold Number: 0
```

```
117 Elapsed time:  0.2164020538330078
118 Model Name: AILGBM, Fold Number: 0
119 Elapsed time:  0.08267569541931152
120 Model Name: RF, Fold Number: 1
121 Elapsed time:  0.18846726417541504
122 Model Name: XGB, Fold Number: 1
123 Elapsed time:  0.08768153190612793
124 Model Name: LGBM, Fold Number: 1
125 Elapsed time:  0.23154258728027344
126 Model Name: AILGBM, Fold Number: 1
127 Elapsed time:  0.1022498607635498
128 Model Name: RF, Fold Number: 2
129 Elapsed time:  0.196563720703125
130 Model Name: XGB, Fold Number: 2
131 Elapsed time:  0.10620927810668945
132 Model Name: LGBM, Fold Number: 2
133 Elapsed time:  0.2068493366241455
134 Model Name: AILGBM, Fold Number: 2
135 Elapsed time:  0.07314109802246094
136 Model Name: RF, Fold Number: 3
137 Elapsed time:  0.1965329647064209
138 Model Name: XGB, Fold Number: 3
139 Elapsed time:  0.08886885643005371
140 Model Name: LGBM, Fold Number: 3
141 Elapsed time:  0.22029948234558105
142 Model Name: AILGBM, Fold Number: 3
143 Elapsed time:  0.07051634788513184
144 Model Name: RF, Fold Number: 4
145 Elapsed time:  0.19774842262268066
146 Model Name: XGB, Fold Number: 4
147 Elapsed time:  0.08151054382324219
148 Model Name: LGBM, Fold Number: 4
149 Elapsed time:  0.18939828872680664
150 Model Name: AILGBM, Fold Number: 4
151 Elapsed time:  0.0765237808227539
152 Accuracy of Meta model: 1.0
153 Elapsed time for Meta Prediction: 0.
    0049997968673706055 for fold 0:
154 Accuracy of Meta model: 0.984375
155 Elapsed time for Meta Prediction: 0.
    0495195388793453 for fold 1:
```

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156 Accuracy of Meta model: 0.984375
157 Elapsed time for Meta Prediction: 0.
    04800081253051758 for fold 2:
158 Accuracy of Meta model: 1.0
159 Elapsed time for Meta Prediction: 0.
    032004356384277344 for fold 3:
160 Accuracy of Meta model: 0.9846153846153847
161 Elapsed time for Meta Prediction: 0.
    05151176452636719 for fold 4:
162 Ensemble accuracy: 1.0
163 Elapsed time for RF model: 0.19468164443969727
164 Random Forest Individual Performance: 1.0
165 Elapsed time for XGB model: 0.0886528491973877
166 XGBoost Individual Performance: 1.0
167 Elapsed time for LightGBM model: 0.205036163330078125
168 LightGBM Individual Performance: 1.0
169 Elapsed time for AILGBM model: 0.10952425003051758
170 AI-LightGBM Individual Performance: 0.99812734082397
171
172 Process finished with exit code 0
173
```