In [46]:

```
# ============================== Loading libraries ==============================
%matplotlib inline
import warnings
warnings.filterwarnings("ignore")

import pickle
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
from sklearn.cross_validation import train_test_split
from sklearn.neighbors import KNeighborsClassifier
from sklearn.metrics import accuracy_score
from sklearn.cross_validation import cross_val_score
from collections import Counter
from sklearn.metrics import accuracy_score
from sklearn import cross_validation
from sklearn.naive_bayes import MultinomialNB
from sklearn.metrics import f1_score
from sklearn.model_selection import GridSearchCV
from sklearn.datasets import *
from sklearn.linear_model import LogisticRegression
from sklearn.model_selection import RandomizedSearchCV
from sklearn.metrics import precision_recall_fscore_support
from sklearn.metrics import classification_report
from prettytable import PrettyTable
import random
from scipy.stats import uniform
from sklearn.metrics import roc_curve, auc
from sklearn.learning_curve import validation_curve
from sklearn.metrics import fbeta_score, make_scorer
from sklearn.metrics import precision_score, recall_score,roc_auc_score
from sklearn.ensemble import ExtraTreesClassifier
from sklearn.feature_selection import SelectKBest
from sklearn.feature_selection import chi2
from sklearn.feature_selection import SelectFromModel
from sklearn.preprocessing import StandardScaler
from sklearn.calibration import CalibratedClassifierCV
import joblib
from sklearn.svm import SVC
from sklearn import svm
from sklearn import linear_model
from scipy import stats
import scikitplot as skplt
from wordcloud import WordCloud, STOPWORDS

import sqlite3
import pandas as pd
import numpy as np
import nltk
import string
import matplotlib.pyplot as plt
import seaborn as sns
from sklearn.feature_extraction.text import TfidfTransformer
from sklearn.feature_extraction.text import TfidfVectorizer
from sklearn.cluster import KMeans
from sklearn.cluster import AgglomerativeClustering
from sklearn.cluster import DBSCAN


from sklearn.ensemble import RandomForestClassifier

from sklearn.feature_extraction.text import CountVectorizer
from sklearn.metrics import confusion_matrix
from sklearn import metrics
from sklearn.metrics import roc_curve, auc
from nltk.stem.porter import PorterStemmer

#import nltk
#nltk.download('stopwords')

import re
# Tutorial about Python regular expressions: https://pymotw.com/2/re/
import string
from nltk.corpus import stopwords
from nltk.stem import PorterStemmer
from nltk.stem.wordnet import WordNetLemmatizer

#from gensim.models import KeyedVectors
#model = KeyedVectors.load_word2vec_format(‘GoogleNews-vectors-negative300.bin.g

#import gensim
from gensim.models import Word2Vec
from gensim.models import KeyedVectors
from sklearn.decomposition import TruncatedSVD
from sklearn import tree
import graphviz

import xgboost as xgb

# ==============================================================================
```

In [47]:

```
fileObject = open("./train_to_file.pkl",'rb') # we open the file for reading
X_train = pickle.load(fileObject) # load the object from the file

fileObject = open("./x_cv_to_file.pkl",'rb') # we open the file for reading
X_cv = pickle.load(fileObject) # load the object from the file

fileObject = open("./x_test_to_file.pkl",'rb') # we open the file for reading
X_test = pickle.load(fileObject) # load the object from the file

fileObject = open("./y_train_to_file.pkl",'rb') # we open the file for reading
y_train = pickle.load(fileObject) # load the object from the file

fileObject = open("./y_cv_to_file.pkl",'rb') # we open the file for reading
y_cv = pickle.load(fileObject) # load the object from the file

fileObject = open("./y_test_to_file.pkl",'rb') # we open the file for reading
y_test = pickle.load(fileObject) # load the object from the file
```

In [48]:

```
fileObject = open("./final_to_file2.pkl",'rb') # we open the file for reading
final2 = pickle.load(fileObject) # load the object from the file
```

In [49]:
```
final2
```

Out[49]:

	Id	ProductId	UserId	ProfileName	HelpfulnessNumerator	He
138706	150524	0006641040	ACITT7DI6IDDL	shari zychinski	0	
138683	150501	0006641040	AJ46FKXOVC7NR	Nicholas A Mesiano	2	
417839	451856	B00004CXX9	AIUWLEQ1ADEG5	Elizabeth Medina	0	
417859	451878	B00004CXX9	A344SMIA5JECGM	Vincent P. Ross	1	

BoW

In [50]:
```
#Appling BoW to fit and transform
count_vect =  CountVectorizer()
bow_NB = count_vect.fit(X_train[:,9])
train_bow_nstd = count_vect.transform(X_train[:,9])
cv_bow_nstd = count_vect.transform(X_cv[:,9])
test_bow_nstd = count_vect.transform(X_test[:,9])

print("the type of count vectorizer ",type(train_bow_nstd))
print("the number of unique words ", test_bow_nstd.get_shape()[1])

print(train_bow_nstd.shape)
print(cv_bow_nstd.shape)
print(test_bow_nstd.shape)
print(y_train.shape)
print(y_cv.shape)
print(y_test.shape)
```

```
the type of count vectorizer  <class 'scipy.sparse.csr.csr_matrix'>
the number of unique words  37996
(38400, 37996)
(9600, 37996)
(12000, 37996)
(38400,)
(9600,)
(12000,)
```

In [51]:

```
# Column Standardization of the BoW non-standard vector
std_scal = StandardScaler(with_mean=False)
std_scal.fit(train_bow_nstd)
train_bow = std_scal.transform(train_bow_nstd)
cv_bow = std_scal.transform(cv_bow_nstd)
test_bow = std_scal.transform(test_bow_nstd)
```

TF-IDF

In [265]:

```
#tf-idf on train data
tf_idf_vect = TfidfVectorizer(ngram_range=(1,1)) #considering only uni-gram as I
train_tf_idf_nstd = tf_idf_vect.fit_transform(X_train[:,9]) #sparse matrix
cv_tfidf_nstd = tf_idf_vect.transform(X_cv[:,9])
test_tfidf_nstd = tf_idf_vect.transform(X_test[:,9])
print(train_tf_idf_nstd.shape)
print(cv_tfidf_nstd.shape)
print(test_tfidf_nstd.shape)
```

```
(38400, 37996)
(9600, 37996)
(12000, 37996)
```

In [266]:

```
# Column Standardization of the tfidf non-standard vector
std_scal = StandardScaler(with_mean=False)
std_scal.fit(train_tf_idf_nstd)
train_tfidf = std_scal.transform(train_tf_idf_nstd)
cv_tfidf = std_scal.transform(cv_tfidf_nstd)
test_tfidf = std_scal.transform(test_tfidf_nstd)
```

Avg W2V

In [284]:

```
fileObject = open("./final_to_file2.pkl",'rb') # we open the file for reading
final = pickle.load(fileObject) # load the object from the file
```

In [285]:

```
#w2v
# Train your own Word2Vec model using your own text corpus
i=0
list_of_sent=[]
for sent in final['CleanedText'].values:
    list_of_sent.append(sent.split())

print(type(list_of_sent))
print(final['CleanedText'].values[0])
print("*****************************************************************")
print(list_of_sent[0])
```

```
<class 'list'>
witti littl book make son laugh loud recit car drive along alway sing refrain h
es learn whale india droop love new word book introduc silli classic book will
bet son still abl recit memori colleg
*****************************************************************
['witti', 'littl', 'book', 'make', 'son', 'laugh', 'loud', 'recit', 'car', 'dri
ve', 'along', 'alway', 'sing', 'refrain', 'hes', 'learn', 'whale', 'india', 'dr
oop', 'love', 'new', 'word', 'book', 'introduc', 'silli', 'classic', 'book', 'w
ill', 'bet', 'son', 'still', 'abl', 'recit', 'memori', 'colleg']
```

In [286]:

```
w2v_model=Word2Vec(list_of_sent,min_count=5,size=50, workers=4)
w2v_words = list(w2v_model.wv.vocab)
```

In [287]:

```
# average Word2Vec
# compute average word2vec for each review.
sent_vectors = []; # the avg-w2v for each sentence/review is stored in this list
for sent in list_of_sent: # for each review/sentence
    sent_vec = np.zeros(50) # as word vectors are of zero length
    cnt_words =0; # num of words with a valid vector in the sentence/review
    for word in sent: # for each word in a review/sentence
        if word in w2v_words:
            vec = w2v_model.wv[word]
            sent_vec += vec
            cnt_words += 1
    if cnt_words != 0:
        sent_vec /= cnt_words
    sent_vectors.append(sent_vec)
print(len(sent_vectors))
#print(len(sent_vectors[0]))
print(type(sent_vectors))
```

```
60000
<class 'list'>
```

In [288]:

```
# create design matrix X and target vector y
X = np.array(sent_vectors[::]) # end index is exclusive
y = np.array(final['Score']) # showing you two ways of indexing a pandas df
```

In [289]:

```
X_train_nstd = X[0:38400:1]
X_cv_nstd = X[38400:48000:1]
X_test_nstd = X[48000:60000:1]

y_train_nstd = y[0:38400:1]
y_cv_nstd = y[38400:48000:1]
y_test_nstd =y[48000:60000:1]

print(X_train_nstd.shape)
print(X_cv_nstd.shape)
print(X_test_nstd.shape)
print(y_train_nstd.shape)
print(y_cv_nstd.shape)
print(y_test_nstd.shape)
```

```
(38400, 50)
(9600, 50)
(12000, 50)
(38400,)
(9600,)
(12000,)
```

In [290]:

```
# Column Standardization of the tfidf non-standard vector
std_scal = StandardScaler(with_mean=False)
std_scal.fit(X_train_nstd)
train_avgw2v = std_scal.transform(X_train_nstd)
cv_avgw2v = std_scal.transform(X_cv_nstd)
test_avgw2v = std_scal.transform(X_test_nstd)
```

tfidf-W-w2v

In [291]:

```
# S = ["abc def pqr", "def def def abc", "pqr pqr def"]
model = TfidfVectorizer()
tf_idf_matrix = model.fit_transform(final['CleanedText'].values)
# we are converting a dictionary with word as a key, and the idf as a value
dictionary = dict(zip(model.get_feature_names(), list(model.idf_)))
```

In [292]:

```
# TF-IDF weighted Word2Vec
tfidf_feat = model.get_feature_names() # tfidf words/col-names
# final_tf_idf is the sparse matrix with row= sentence, col=word and cell_val = t

tfidf_sent_vectors = []; # the tfidf-w2v for each sentence/review is stored in th
row=0;
for sent in (list_of_sent): # for each review/sentence
    sent_vec = np.zeros(50) # as word vectors are of zero length
    weight_sum =0; # num of words with a valid vector in the sentence/review
    for word in sent: # for each word in a review/sentence
        if word in w2v_words:
            vec = w2v_model.wv[word]
#             tf_idf = tf_idf_matrix[row, tfidf_feat.index(word)]
            # to reduce the computation we are
            # dictionary[word] = idf value of word in whole courpus
            # sent.count(word) = tf valeus of word in this review
            tf_idf = dictionary[word]*(sent.count(word)/len(sent))
            sent_vec += (vec * tf_idf)
            weight_sum += tf_idf
    if weight_sum != 0:
        sent_vec /= weight_sum
    tfidf_sent_vectors.append(sent_vec)
    row += 1
```

In [293]:

```
print(len(tfidf_sent_vectors))
print(np.shape(tfidf_sent_vectors))
print(type(tfidf_sent_vectors))
```

```
60000
(60000, 50)
<class 'list'>
```

In [294]:

```
# create design matrix X and target vector y
X = np.array(sent_vectors[::]) # end index is exclusive
y = np.array(final['Score']) # showing you two ways of indexing a pandas df
```

In [295]:

```
X_train_nstd = X[0:38400:1]
X_cv_nstd = X[38400:48000:1]
X_test_nstd = X[48000:60000:1]

y_train_nstd = y[0:38400:1]
y_cv_nstd = y[38400:48000:1]
y_test_nstd =y[48000:60000:1]

print(X_train_nstd.shape)
print(X_cv_nstd.shape)
print(X_test_nstd.shape)
print(y_train_nstd.shape)
print(y_cv_nstd.shape)
print(y_test_nstd.shape)
```

```
(38400, 50)
(9600, 50)
(12000, 50)
(38400,)
(9600,)
(12000,)
```

In [296]:

```
# Column Standardization of the tfidf non-standard vector
std_scal = StandardScaler(with_mean=False)
std_scal.fit(X_train_nstd)
train_tfidfww2v = std_scal.transform(X_train_nstd)
cv_tfidfww2v = std_scal.transform(X_cv_nstd)
test_tfidfww2v = std_scal.transform(X_test_nstd)
```

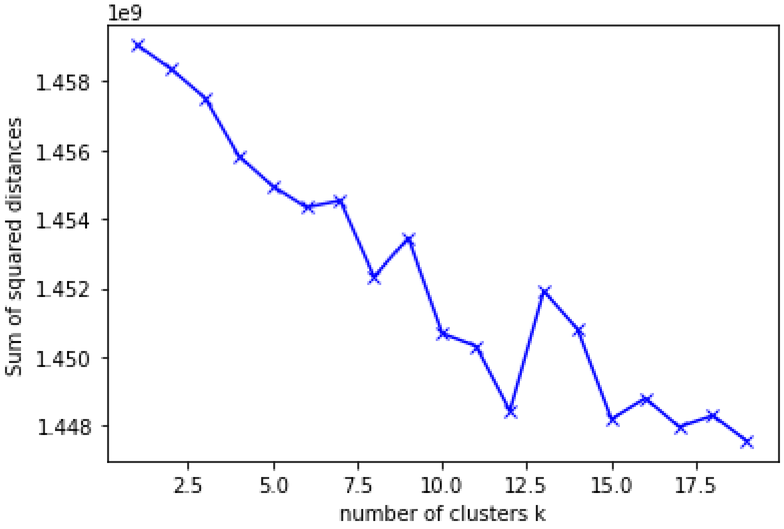
K-Means on BoW

In [35]:

```
sum_squared_dist = []
K = range(1,20)
for k in K:
    km_bow = KMeans(n_clusters=k, random_state=0)
    km_bow = km_bow.fit(train_bow, y_train)
    sum_squared_dist.append(km_bow.inertia_)
plt.plot(K, sum_squared_dist, 'bx-')
plt.xlabel('number of clusters k')
plt.ylabel('Sum of squared distances')
plt.show
```

Out[35]:

```
<function matplotlib.pyplot.show(*args, **kw)>
```



In [43]:

```
joblib.dump(sum_squared_dist,"sum_squared_dist.pkl")
joblib.dump(km_bow,"km_bow.pkl")
```

Out[43]:

```
['km_bow.pkl']
```

In [66]:

```
sum_squared_dist = joblib.load("sum_squared_dist.pkl")
km_bow = joblib.load("km_bow.pkl")
```

In [187]:

```
#taking K=6 in for BoW
km_bow_best = KMeans(n_clusters=6, random_state=0)
km_bow_best = km_bow_best.fit(train_bow, y_train)
```

In [262]:

```
joblib.dump(km_bow_best,"km_bow_best.pkl")
```

Out[262]:

```
['km_bow_best.pkl']
```

In [263]:

```
km_bow_best = joblib.load("km_bow_best.pkl")
```

In [188]:

```
labels = km_bow_best.labels_
print(np.shape(labels))
print(type(labels))
labels_df = pd.DataFrame(labels)
print(type(labels_df))
print(np.shape(labels_df))
```

```
(38400,)
<class 'numpy.ndarray'>
<class 'pandas.core.frame.DataFrame'>
(38400, 1)
```

In [189]:

```
#matching the number of rows
final3 = final2[0:38400]
print(type(final3))
print(final3.shape)
#final3
```

```
<class 'pandas.core.frame.DataFrame'>
(38400, 11)
```

In [196]:

```
#adding the values of labels in the data frame
final4 = final3
print(type(final4))
final4.reindex(columns=[*final4.columns.tolist(), 'labels'],fill_value=1)
final4['labels']=labels_df.values
final4
```

```
<class 'pandas.core.frame.DataFrame'>
```

In [191]:
```
#reseting the index (not required now)
final4 = final4.reset_index()
final4
```

6	417847	451864	B00004CXX9	A1B2IZU1JLZA6	Wes
7	70688	76882	B00002N8SM	A32DW342WBJ6BX	Buttersugar
8	346141	374450	B00004CI84	ACJR7EQF9S6FP	Jeremy Robertson
9	417883	451903	B00004CXX9	A2DEE7F9XKP3ZR	jerome

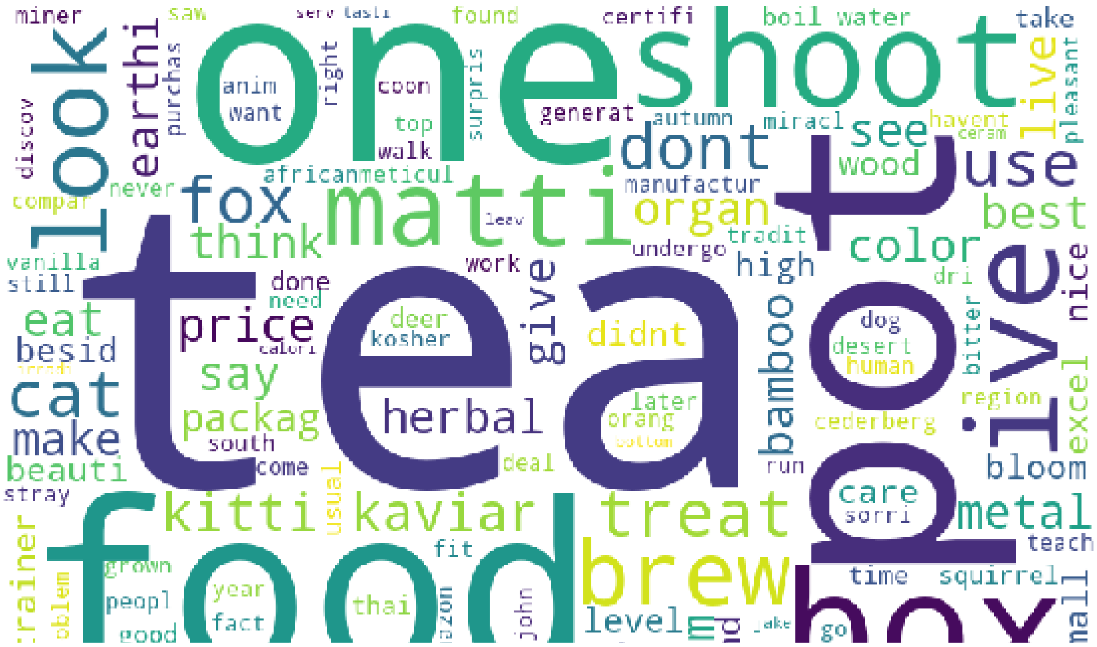
In [247]:

```
clean_text_all = list()

#copying all the data rows with label=0
clean_text_cat_0 = list()
for loop1 in range(0,38400):
    if (((final4['labels'].values)[loop1]) == 0):
        clean_text_cat_0.append(((final4['CleanedText'].values)[loop1]))
clean_text_all.append(clean_text_cat_0)

#copying all the data rows with label=1
clean_text_cat_1 = list()
for loop1 in range(0,38400):
    if (((final4['labels'].values)[loop1]) == 1):
        clean_text_cat_1.append(((final4['CleanedText'].values)[loop1]))
clean_text_all.append(clean_text_cat_1)

#copying all the data rows with label=2
clean_text_cat_2 = list()
for loop1 in range(0,38400):
    if (((final4['labels'].values)[loop1]) == 2):
        clean_text_cat_2.append(((final4['CleanedText'].values)[loop1]))
clean_text_all.append(clean_text_cat_2)

#copying all the data rows with label=3
clean_text_cat_3 = list()
for loop1 in range(0,38400):
    if (((final4['labels'].values)[loop1]) == 3):
        clean_text_cat_3.append(((final4['CleanedText'].values)[loop1]))
clean_text_all.append(clean_text_cat_3)

#copying all the data rows with label=4
clean_text_cat_4 = list()
for loop1 in range(0,38400):
    if (((final4['labels'].values)[loop1]) == 4):
        clean_text_cat_4.append(((final4['CleanedText'].values)[loop1]))
clean_text_all.append(clean_text_cat_4)

#copying all the data rows with label=5
clean_text_cat_5 = list()
for loop1 in range(0,38400):
    if (((final4['labels'].values)[loop1]) == 5):
        clean_text_cat_5.append(((final4['CleanedText'].values)[loop1]))
clean_text_all.append(clean_text_cat_5)

#copying all the data rows with label=6
clean_text_cat_6 = list()
for loop1 in range(0,38400):
    if (((final4['labels'].values)[loop1]) == 6):
        clean_text_cat_6.append(((final4['CleanedText'].values)[loop1]))
clean_text_all.append(clean_text_cat_6)
```

In [258]:

```
def wordcloud_print(clean_text):
#source: https://www.geeksforgeeks.org/generating-word-cloud-python/
    comment_words = ' '
    stopwords = set(STOPWORDS)

    for j in clean_text:
    # iterate through the csv file
        for val in (j):

        # typecaste each val to string
            val = str(val)

        # split the value
            tokens = val.split()

        # Converts each token into lowercase
            for i in range(len(tokens)):
                tokens[i] = tokens[i].lower()

            for words in tokens:
                comment_words = comment_words + words + ' '


        wordcloud = WordCloud(width = 800, height = 800,
                background_color ='white',
                stopwords = stopwords,
                min_font_size = 10).generate(comment_words)

        # plot the WordCloud image
        plt.figure(figsize = (8, 8), facecolor = None)
        plt.imshow(wordcloud)
        plt.axis("off")
        plt.tight_layout(pad = 0)

        plt.show()
        comment_words = ' '
```

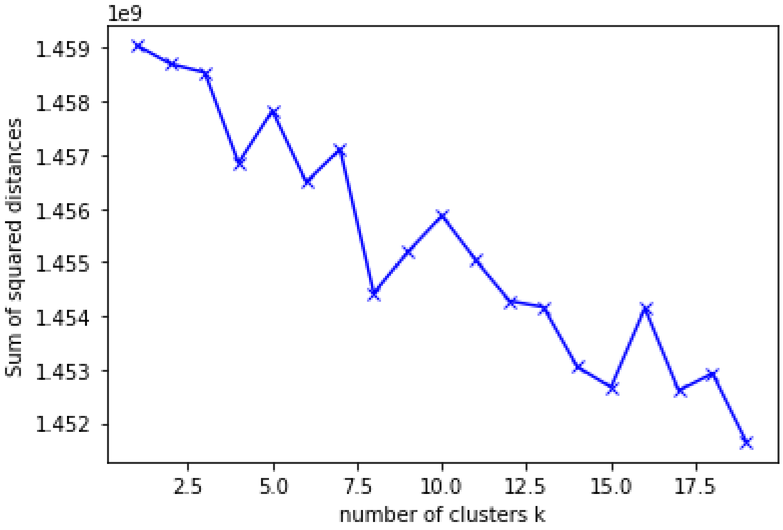
In [260]:
```
wordcloud_print(clean_text_all)
```



K-Means of tfidf

In [37]:
```
sum_squared_dist_tfidf = []
K = range(1,20)
for k in K:
    km_tfidf = KMeans(n_clusters=k, random_state=0)
    km_tfidf = km_tfidf.fit(train_tfidf, y_train)
    sum_squared_dist_tfidf.append(km_tfidf.inertia_)
plt.plot(K, sum_squared_dist_tfidf, 'bx-')
plt.xlabel('number of clusters k')
plt.ylabel('Sum of squared distances')
plt.show
```

Out[37]:
```
<function matplotlib.pyplot.show(*args, **kw)>
```



In [42]:

```
joblib.dump(sum_squared_dist_tfidf,"sum_squared_dist_tfidf.pkl")
joblib.dump(km_tfidf,"km_tfidf.pkl")
```

Out[42]:

```
['km_tfidf.pkl']
```

In [164]:

```
sum_squared_dist_tfidf = joblib.load("sum_squared_dist_tfidf.pkl")
km_tfidf = joblib.load("km_tfidf.pkl")
```

In [267]:

```
#taking K=6 in for tfidf
km_tfidf_best = KMeans(n_clusters=6, random_state=0)
km_tfidf_best = km_tfidf_best.fit(train_tfidf, y_train)
```

In [268]:

```
joblib.dump(km_tfidf_best,"km_tfidf_best.pkl")
```

Out[268]:

```
['km_tfidf_best.pkl']
```

In [269]:

```
km_tfidf_best = joblib.load("km_tfidf_best.pkl")
```

In [270]:

```
labels_tfidf = km_tfidf_best.labels_
print(np.shape(labels_tfidf))
print(type(labels_tfidf))
labels_tfidf_df = pd.DataFrame(labels_tfidf)
print(type(labels_tfidf_df))
print(np.shape(labels_tfidf_df))
```

```
(38400,)
<class 'numpy.ndarray'>
<class 'pandas.core.frame.DataFrame'>
(38400, 1)
```

In [271]:

```
#matching the number of rows
final3 = final2[0:38400]
print(type(final3))
print(final3.shape)
#final3
```

```
<class 'pandas.core.frame.DataFrame'>
(38400, 11)
```

In [272]:

```
#adding the values of labels in the data frame
final4 = final3
print(type(final4))
final4.reindex(columns=[*final4.columns.tolist(), 'labels'],fill_value=1)
final4['labels']=labels_tfidf_df.values
final4
```

```
<class 'pandas.core.frame.DataFrame'>
```

In [274]:

```
clean_text_all_tfidf = list()

#copying all the data rows with label=0
clean_text_cat_0 = list()
for loop1 in range(0,38400):
    if (((final4['labels'].values)[loop1]) == 0):
        clean_text_cat_0.append(((final4['CleanedText'].values)[loop1]))
clean_text_all_tfidf.append(clean_text_cat_0)

#copying all the data rows with label=1
clean_text_cat_1 = list()
for loop1 in range(0,38400):
    if (((final4['labels'].values)[loop1]) == 1):
        clean_text_cat_1.append(((final4['CleanedText'].values)[loop1]))
clean_text_all_tfidf.append(clean_text_cat_1)

#copying all the data rows with label=2
clean_text_cat_2 = list()
for loop1 in range(0,38400):
    if (((final4['labels'].values)[loop1]) == 2):
        clean_text_cat_2.append(((final4['CleanedText'].values)[loop1]))
clean_text_all_tfidf.append(clean_text_cat_2)

#copying all the data rows with label=3
clean_text_cat_3 = list()
for loop1 in range(0,38400):
    if (((final4['labels'].values)[loop1]) == 3):
        clean_text_cat_3.append(((final4['CleanedText'].values)[loop1]))
clean_text_all_tfidf.append(clean_text_cat_3)

#copying all the data rows with label=4
clean_text_cat_4 = list()
for loop1 in range(0,38400):
    if (((final4['labels'].values)[loop1]) == 4):
        clean_text_cat_4.append(((final4['CleanedText'].values)[loop1]))
clean_text_all_tfidf.append(clean_text_cat_4)

#copying all the data rows with label=5
clean_text_cat_5 = list()
for loop1 in range(0,38400):
    if (((final4['labels'].values)[loop1]) == 5):
        clean_text_cat_5.append(((final4['CleanedText'].values)[loop1]))
clean_text_all_tfidf.append(clean_text_cat_5)

#copying all the data rows with label=6
clean_text_cat_6 = list()
for loop1 in range(0,38400):
    if (((final4['labels'].values)[loop1]) == 6):
        clean_text_cat_6.append(((final4['CleanedText'].values)[loop1]))
clean_text_all_tfidf.append(clean_text_cat_6)
```

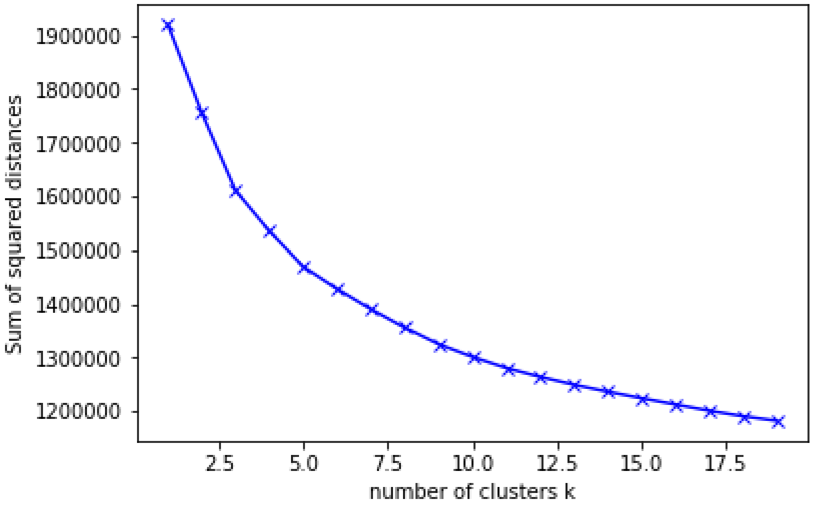
In [282]:
```
wordcloud_print(clean_text_all_tfidf)
```

one
flavor
love
product
realli
littl
wonder
food
best
bit
box
give
bought
come
nice
tri
found
mix
think
made
much
enjoy
need
take
thing
work
without
got
milk
item
quick
blend
plea
kid
better
sauc
stuff
still
seem
prefer
contain
chew
way
friend
water
happi
home
regular
meal
problem
dog
salt
includ
thought
bag
candi
tast
great
ship
bar
live
lot
peopl
year
probabl
bottl
small
add
big
buy
sugar
cooki
sweet
recommend
high
serv
store
grocer
price
natur
help
sinc
healthi
fill
call
someth
cat
textur
disappoint
purcha
cracker
see
thank
top
place
said
mani
first
chip
either
hand
varieti
almost
green
tea
enough
start
find
treat
alway
cook
dri
back

K-Means on avgW2V

In [38]:
```
sum_squared_dist_avgw2v = []
K = range(1,20)
for k in K:
    km_avgw2v = KMeans(n_clusters=k, random_state=0)
    km_avgw2v = km_avgw2v.fit(train_avgw2v, y_train)
    sum_squared_dist_avgw2v.append(km_avgw2v.inertia_)
plt.plot(K, sum_squared_dist_avgw2v, 'bx-')
plt.xlabel('number of clusters k')
plt.ylabel('Sum of squared distances')
plt.show
```

Out[38]:
```
<function matplotlib.pyplot.show(*args, **kw)>
```



In [48]:
```
joblib.dump(sum_squared_dist_avgw2v,"sum_squared_dist_avgw2v.pkl")
joblib.dump(km_avgw2v,"km_avgw2v.pkl")
```

Out[48]:
```
['km_avgw2v.pkl']
```

In [49]:
```
sum_squared_dist_avgw2v = joblib.load("sum_squared_dist_avgw2v.pkl")
km_avgw2v = joblib.load("km_avgw2v.pkl")
```

In [297]:
```
#taking K=6 in for avgW2V
km_avgw2v_best = KMeans(n_clusters=6, random_state=0)
km_avgw2v_best = km_avgw2v_best.fit(train_avgw2v, y_train)
```

In [298]:
```
joblib.dump(km_avgw2v_best,"km_avgw2v_best.pkl")
```

Out[298]:
```
['km_avgw2v_best.pkl']
```

In [299]:
```
km_avgw2v_best = joblib.load("km_avgw2v_best.pkl")
```

In [300]:
```
labels_avgw2v = km_avgw2v_best.labels_
print(np.shape(labels_avgw2v))
print(type(labels_avgw2v))
labels_avgw2v_df = pd.DataFrame(labels_avgw2v)
print(type(labels_avgw2v_df))
print(np.shape(labels_avgw2v_df))
```

```
(38400,)
<class 'numpy.ndarray'>
<class 'pandas.core.frame.DataFrame'>
(38400, 1)
```

In [301]:
```
#matching the number of rows
final3 = final2[0:38400]
print(type(final3))
print(final3.shape)
#final3
```

```
<class 'pandas.core.frame.DataFrame'>
(38400, 11)
```

In [302]:

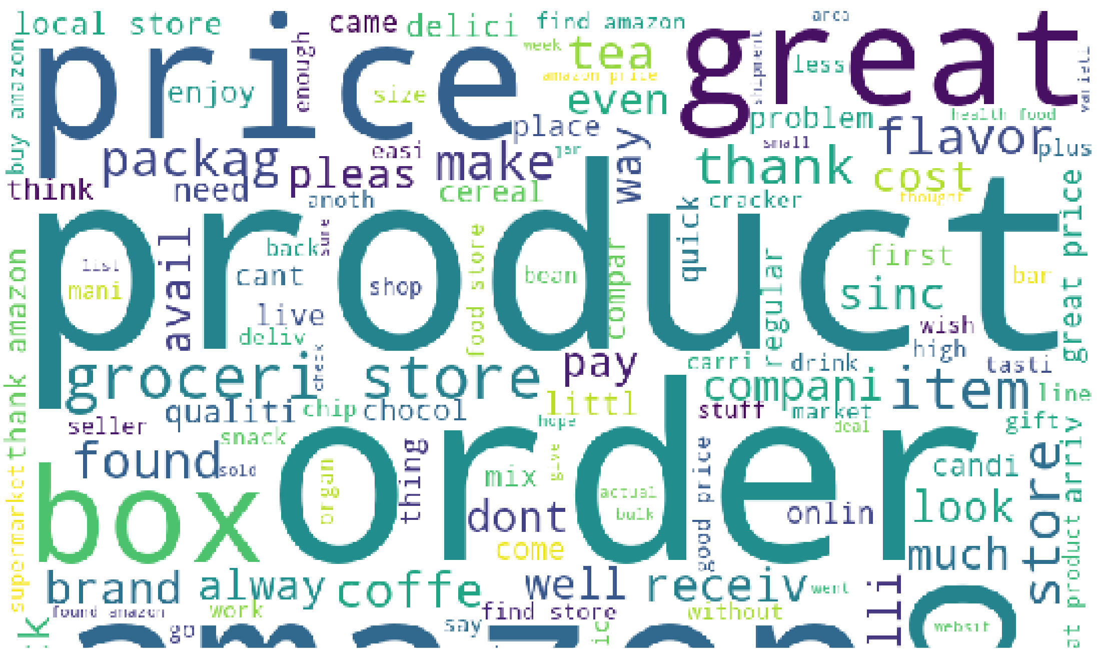
```
#adding the values of labels in the data frame
final4 = final3
print(type(final4))
final4.reindex(columns=[*final4.columns.tolist(), 'labels'],fill_value=1)
final4['labels']=labels_avgw2v_df.values
final4
```

```
<class 'pandas.core.frame.DataFrame'>
```

In [303]:

```python
clean_text_all_avgw2v= list()

#copying all the data rows with label=0
clean_text_cat_0 = list()
for loop1 in range(0,38400):
    if (((final4['labels'].values)[loop1]) == 0):
        clean_text_cat_0.append(((final4['CleanedText'].values)[loop1]))
clean_text_all_avgw2v.append(clean_text_cat_0)

#copying all the data rows with label=1
clean_text_cat_1 = list()
for loop1 in range(0,38400):
    if (((final4['labels'].values)[loop1]) == 1):
        clean_text_cat_1.append(((final4['CleanedText'].values)[loop1]))
clean_text_all_avgw2v.append(clean_text_cat_1)

#copying all the data rows with label=2
clean_text_cat_2 = list()
for loop1 in range(0,38400):
    if (((final4['labels'].values)[loop1]) == 2):
        clean_text_cat_2.append(((final4['CleanedText'].values)[loop1]))
clean_text_all_avgw2v.append(clean_text_cat_2)

#copying all the data rows with label=3
clean_text_cat_3 = list()
for loop1 in range(0,38400):
    if (((final4['labels'].values)[loop1]) == 3):
        clean_text_cat_3.append(((final4['CleanedText'].values)[loop1]))
clean_text_all_avgw2v.append(clean_text_cat_3)

#copying all the data rows with label=4
clean_text_cat_4 = list()
for loop1 in range(0,38400):
    if (((final4['labels'].values)[loop1]) == 4):
        clean_text_cat_4.append(((final4['CleanedText'].values)[loop1]))
clean_text_all_avgw2v.append(clean_text_cat_4)

#copying all the data rows with label=5
clean_text_cat_5 = list()
for loop1 in range(0,38400):
    if (((final4['labels'].values)[loop1]) == 5):
        clean_text_cat_5.append(((final4['CleanedText'].values)[loop1]))
clean_text_all_avgw2v.append(clean_text_cat_5)

#copying all the data rows with label=6
clean_text_cat_6 = list()
for loop1 in range(0,38400):
    if (((final4['labels'].values)[loop1]) == 6):
        clean_text_cat_6.append(((final4['CleanedText'].values)[loop1]))
clean_text_all_avgw2v.append(clean_text_cat_6)
```

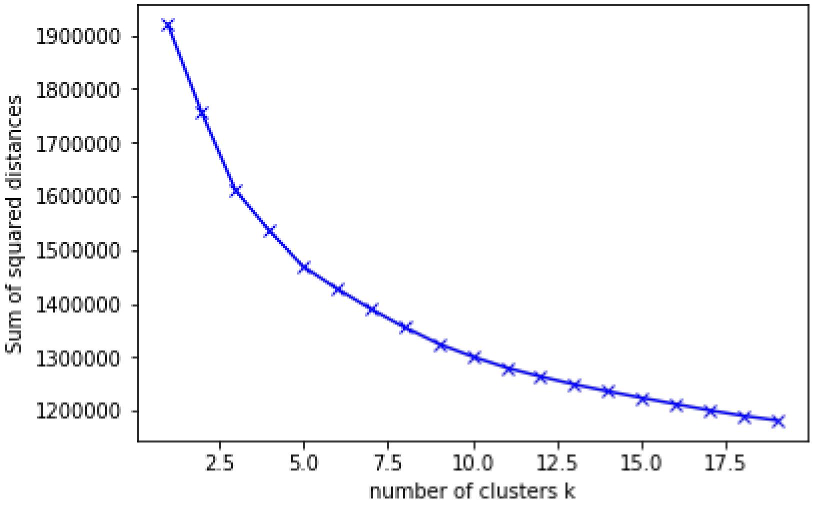
In [304]:
```
wordcloud_print(clean_text_all_avgw2v)
```



K-Means on tfidf-W-W2V

In [39]:
```
sum_squared_dist_tfidfww2v = []
K = range(1,20)
for k in K:
    km_tfidfww2v = KMeans(n_clusters=k, random_state=0)
    km_tfidfww2v = km_tfidfww2v.fit(train_tfidfww2v, y_train)
    sum_squared_dist_tfidfww2v.append(km_tfidfww2v.inertia_)
plt.plot(K, sum_squared_dist_tfidfww2v, 'bx-')
plt.xlabel('number of clusters k')
plt.ylabel('Sum of squared distances')
plt.show
```

Out[39]:
```
<function matplotlib.pyplot.show(*args, **kw)>
```



In [46]:

```
joblib.dump(sum_squared_dist_tfidfww2v,"sum_squared_dist_tfidfww2v.pkl")
joblib.dump(km_tfidfww2v,"km_tfidfww2v.pkl")
```

Out[46]:

```
['km_tfidfww2v.pkl']
```

In [47]:

```
sum_squared_dist_tfidfww2v = joblib.load("sum_squared_dist_tfidfww2v.pkl")
km_tfidfww2v = joblib.load("km_tfidfww2v.pkl")
```

In [305]:

```
#taking K=6 in for avgW2V
km_tfidfww2v_best = KMeans(n_clusters=6, random_state=0)
km_tfidfww2v_best = km_tfidfww2v_best.fit(train_tfidfww2v, y_train)
```

In [306]:

```
joblib.dump(km_tfidfww2v_best,"km_tfidfww2v_best.pkl")
```

Out[306]:

```
['km_tfidfww2v_best.pkl']
```

In [307]:

```
km_tfidfww2v_best = joblib.load("km_tfidfww2v_best.pkl")
```

In [308]:

```
labels_tfidfww2v = km_tfidfww2v_best.labels_
print(np.shape(labels_tfidfww2v))
print(type(labels_tfidfww2v))
labels_tfidfww2v_df = pd.DataFrame(labels_tfidfww2v)
print(type(labels_tfidfww2v_df))
print(np.shape(labels_tfidfww2v_df))
```

```
(38400,)
<class 'numpy.ndarray'>
<class 'pandas.core.frame.DataFrame'>
(38400, 1)
```

In [309]:

```
#matching the number of rows
final3 = final2[0:38400]
print(type(final3))
print(final3.shape)
#final3
```

```
<class 'pandas.core.frame.DataFrame'>
(38400, 11)
```

In [310]:

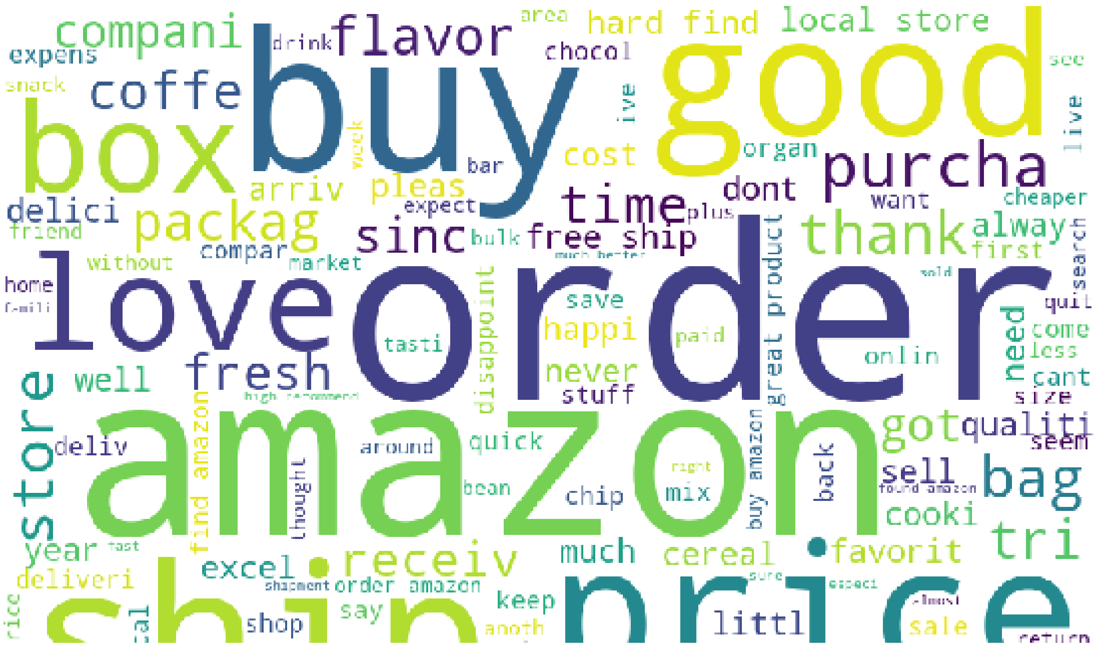
```
#adding the values of labels in the data frame
final4 = final3
print(type(final4))
final4.reindex(columns=[*final4.columns.tolist(), 'labels'],fill_value=1)
final4['labels']=labels_tfidfww2v_df.values
final4
```

```
<class 'pandas.core.frame.DataFrame'>
```

In [311]:

```
clean_text_all_tfidfww2v = list()

#copying all the data rows with label=0
clean_text_cat_0 = list()
for loop1 in range(0,38400):
    if (((final4['labels'].values)[loop1]) == 0):
        clean_text_cat_0.append(((final4['CleanedText'].values)[loop1]))
clean_text_all_tfidfww2v.append(clean_text_cat_0)

#copying all the data rows with label=1
clean_text_cat_1 = list()
for loop1 in range(0,38400):
    if (((final4['labels'].values)[loop1]) == 1):
        clean_text_cat_1.append(((final4['CleanedText'].values)[loop1]))
clean_text_all_tfidfww2v.append(clean_text_cat_1)

#copying all the data rows with label=2
clean_text_cat_2 = list()
for loop1 in range(0,38400):
    if (((final4['labels'].values)[loop1]) == 2):
        clean_text_cat_2.append(((final4['CleanedText'].values)[loop1]))
clean_text_all_tfidfww2v.append(clean_text_cat_2)

#copying all the data rows with label=3
clean_text_cat_3 = list()
for loop1 in range(0,38400):
    if (((final4['labels'].values)[loop1]) == 3):
        clean_text_cat_3.append(((final4['CleanedText'].values)[loop1]))
clean_text_all_tfidfww2v.append(clean_text_cat_3)

#copying all the data rows with label=4
clean_text_cat_4 = list()
for loop1 in range(0,38400):
    if (((final4['labels'].values)[loop1]) == 4):
        clean_text_cat_4.append(((final4['CleanedText'].values)[loop1]))
clean_text_all_tfidfww2v.append(clean_text_cat_4)

#copying all the data rows with label=5
clean_text_cat_5 = list()
for loop1 in range(0,38400):
    if (((final4['labels'].values)[loop1]) == 5):
        clean_text_cat_5.append(((final4['CleanedText'].values)[loop1]))
clean_text_all_tfidfww2v.append(clean_text_cat_5)

#copying all the data rows with label=6
clean_text_cat_6 = list()
for loop1 in range(0,38400):
    if (((final4['labels'].values)[loop1]) == 6):
        clean_text_cat_6.append(((final4['CleanedText'].values)[loop1]))
clean_text_all_tfidfww2v.append(clean_text_cat_6)
```

```
In [312]: wordcloud_print(clean_text_all_tfidfww2v)
```



Loading 5K data from disk

```
In [313]: fileObject = open("./train_to_file4.pkl",'rb') # we open the file for reading
          X_train_1 = pickle.load(fileObject) # load the object from the file

          fileObject = open("./y_train_to_file4.pkl",'rb') # we open the file for reading
          y_train_1 = pickle.load(fileObject) # load the object from the file
```

```
In [314]: fileObject = open("./final_to_file4.pkl",'rb') # we open the file for reading
          final = pickle.load(fileObject) # load the object from the file
```

avgW2V

In [315]:

```
#w2v
# Train your own Word2Vec model using your own text corpus
i=0
list_of_sent=[]
for sent in final['CleanedText'].values:
    list_of_sent.append(sent.split())

print(type(list_of_sent))
print(final['CleanedText'].values[0])
print("*****************************************************************")
print(list_of_sent[0])
```

```
<class 'list'>
witti littl book make son laugh loud recit car drive along alway sing refrain h
es learn whale india droop love new word book introduc silli classic book will
bet son still abl recit memori colleg
*****************************************************************
['witti', 'littl', 'book', 'make', 'son', 'laugh', 'loud', 'recit', 'car', 'dri
ve', 'along', 'alway', 'sing', 'refrain', 'hes', 'learn', 'whale', 'india', 'dr
oop', 'love', 'new', 'word', 'book', 'introduc', 'silli', 'classic', 'book', 'w
ill', 'bet', 'son', 'still', 'abl', 'recit', 'memori', 'colleg']
```

In [316]:

```
w2v_model=Word2Vec(list_of_sent,min_count=5,size=50, workers=4)
w2v_words = list(w2v_model.wv.vocab)
```

In [317]:

```
# average Word2Vec
# compute average word2vec for each review.
sent_vectors = []; # the avg-w2v for each sentence/review is stored in this list
for sent in list_of_sent: # for each review/sentence
    sent_vec = np.zeros(50) # as word vectors are of zero length
    cnt_words =0; # num of words with a valid vector in the sentence/review
    for word in sent: # for each word in a review/sentence
        if word in w2v_words:
            vec = w2v_model.wv[word]
            sent_vec += vec
            cnt_words += 1
    if cnt_words != 0:
        sent_vec /= cnt_words
    sent_vectors.append(sent_vec)
print(len(sent_vectors))
#print(len(sent_vectors[0]))
print(type(sent_vectors))
```

```
5000
<class 'list'>
```

In [318]:

```
# create design matrix X and target vector y
X = np.array(sent_vectors[::]) # end index is exclusive
y = np.array(final['Score']) # showing you two ways of indexing a pandas df
```

In [319]:

```
X_train_nstd = X[0:5000]
y_train_nstd = y[0:5000]

print(X_train_nstd.shape)
print(y_train_nstd.shape)
```

```
(5000, 50)
(5000,)
```

In [320]:

```
# Column Standardization of the tfidf non-standard vector
std_scal = StandardScaler(with_mean=False)
std_scal.fit(X_train_nstd)
train_avgw2v_1 = std_scal.transform(X_train_nstd)
```

tfidf-W-W2V

In [321]:

```
# S = ["abc def pqr", "def def def abc", "pqr pqr def"]
model = TfidfVectorizer()
tf_idf_matrix = model.fit_transform(final['CleanedText'].values)
# we are converting a dictionary with word as a key, and the idf as a value
dictionary = dict(zip(model.get_feature_names(), list(model.idf_)))
```

In [322]:

```
# TF-IDF weighted Word2Vec
tfidf_feat = model.get_feature_names() # tfidf words/col-names
# final_tf_idf is the sparse matrix with row= sentence, col=word and cell_val = t

tfidf_sent_vectors = []; # the tfidf-w2v for each sentence/review is stored in th
row=0;
for sent in (list_of_sent): # for each review/sentence
    sent_vec = np.zeros(50) # as word vectors are of zero length
    weight_sum =0; # num of words with a valid vector in the sentence/review
    for word in sent: # for each word in a review/sentence
        if word in w2v_words:
            vec = w2v_model.wv[word]
#             tf_idf = tf_idf_matrix[row, tfidf_feat.index(word)]
            # to reduce the computation we are
            # dictionary[word] = idf value of word in whole courpus
            # sent.count(word) = tf valeus of word in this review
            tf_idf = dictionary[word]*(sent.count(word)/len(sent))
            sent_vec += (vec * tf_idf)
            weight_sum += tf_idf
    if weight_sum != 0:
        sent_vec /= weight_sum
    tfidf_sent_vectors.append(sent_vec)
    row += 1
```

In [323]:

```
print(len(tfidf_sent_vectors))
print(np.shape(tfidf_sent_vectors))
print(type(tfidf_sent_vectors))
```

```
5000
(5000, 50)
<class 'list'>
```

In [324]:

```
# create design matrix X and target vector y
X = np.array(sent_vectors[::]) # end index is exclusive
y = np.array(final['Score']) # showing you two ways of indexing a pandas df
```

In [325]:

```
X_train_nstd = X[0:5000]
y_train_nstd = y[0:5000]

print(X_train_nstd.shape)
print(y_train_nstd.shape)
```

```
(5000, 50)
(5000,)
```

In [326]:

```
# Column Standardization of the tfidf non-standard vector
std_scal = StandardScaler(with_mean=False)
std_scal.fit(X_train_nstd)
train_tfidfww2v_1 = std_scal.transform(X_train_nstd)
```

Agglomerative Clustering on avgW2V

In [329]:

```
clf_agc_1 = AgglomerativeClustering(n_clusters = 2) #No. clusters = 2
labels_avgw2v_c2 = clf_agc_1.fit_predict(train_avgw2v_1,y_train_1)
labels_avgw2v_c2
```

Out[329]:

```
array([0, 0, 0, ..., 0, 0, 1], dtype=int64)
```

In [338]:

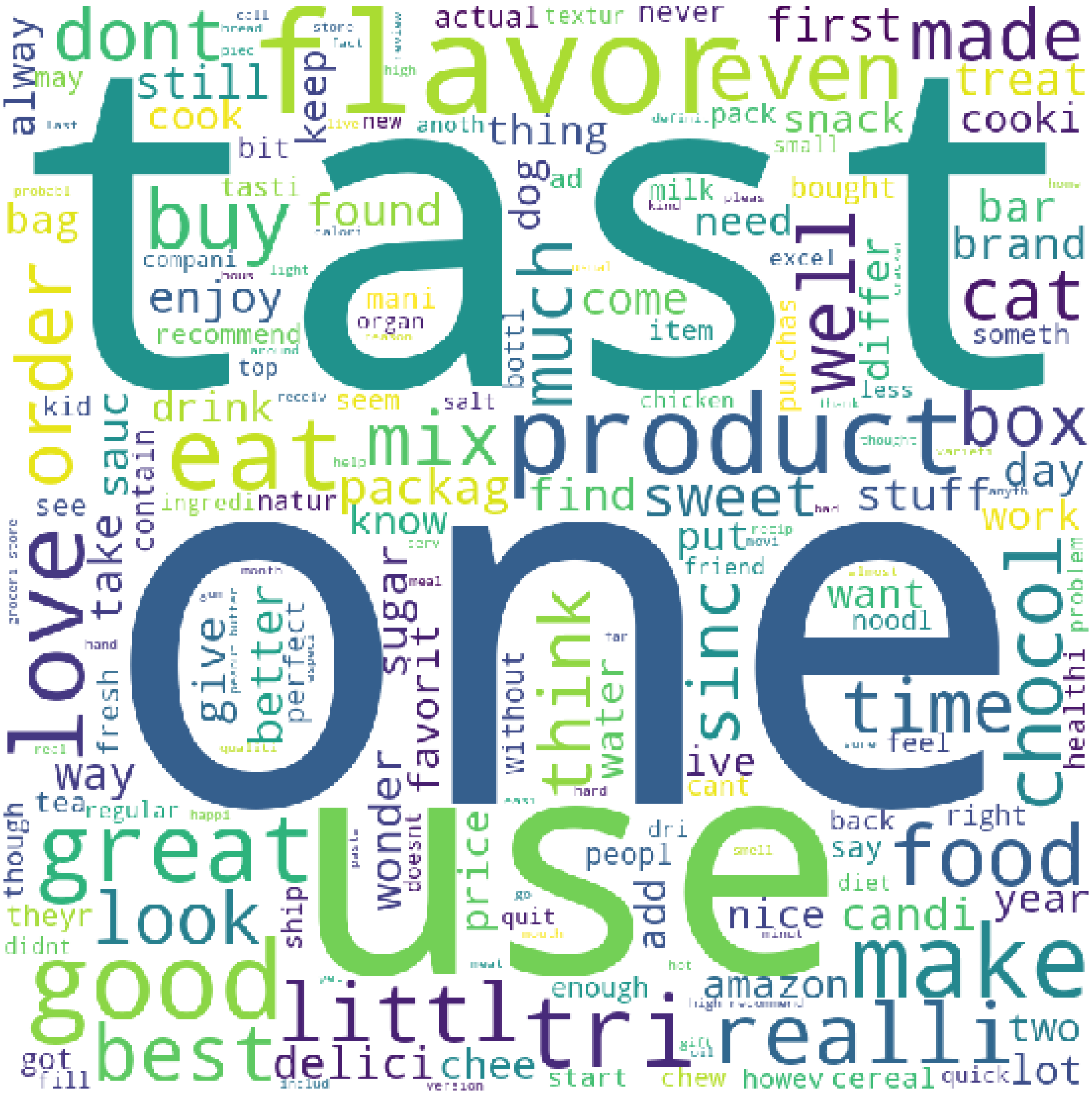
```
print(type(labels_avgw2v_c2))
labels_avgw2v_c2_df = pd.DataFrame(labels_avgw2v_c2)
print(type(labels_avgw2v_c2_df))

#matching the number of rows
final3 = final2[0:5000]
print(type(final3))
print(final3.shape)
#final3

#adding the values of labels in the data frame
final4 = final3
print(type(final4))
final4.reindex(columns=[*final4.columns.tolist(), 'labels'],fill_value=1)
final4['labels']=labels_avgw2v_c2_df.values
final4
```

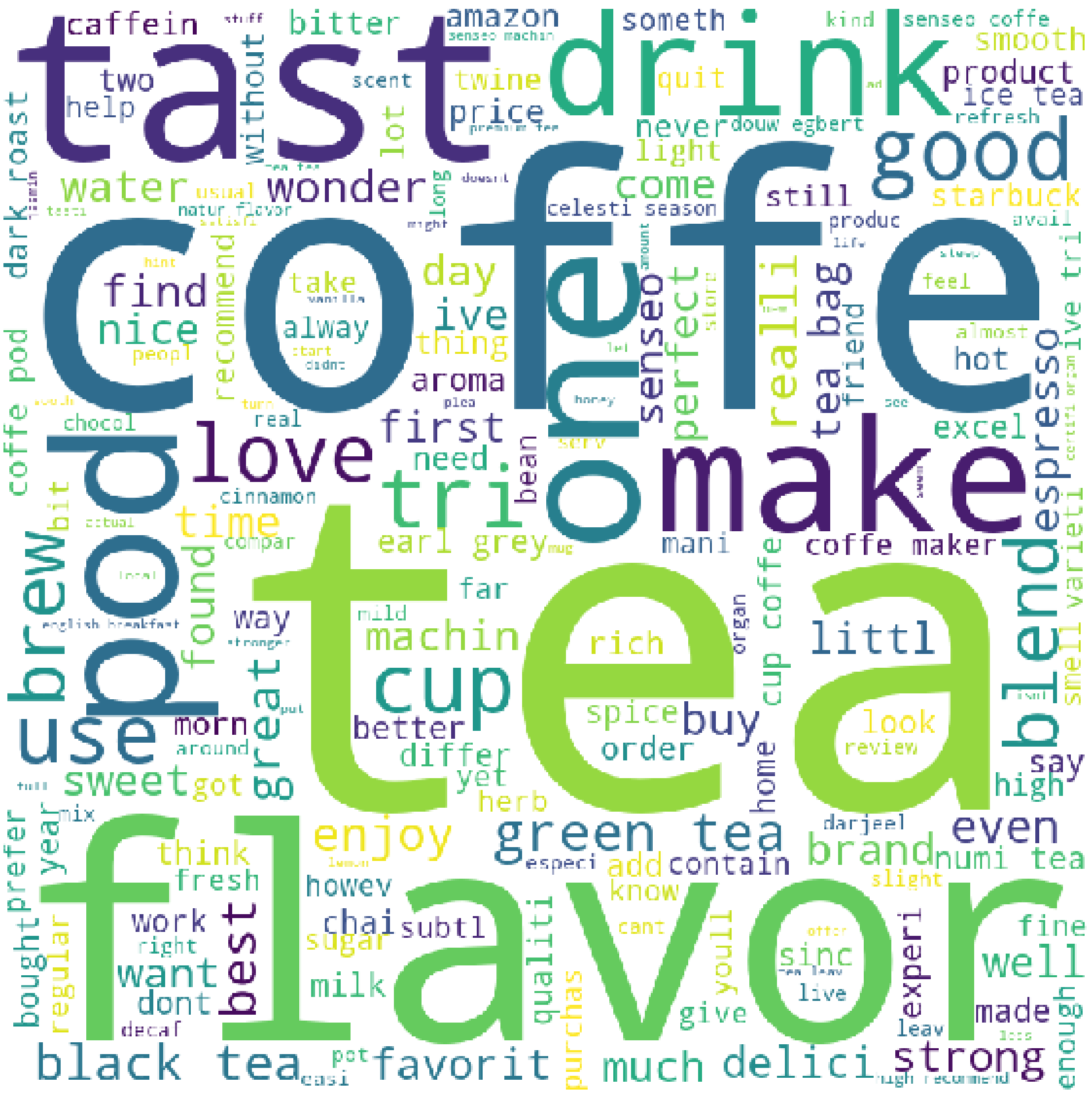
```
<class 'numpy.ndarray'>
<class 'pandas.core.frame.DataFrame'>
<class 'pandas.core.frame.DataFrame'>
(5000, 11)
<class 'pandas.core.frame.DataFrame'>
```

In [340]:

```
clean_text_all_avgw2v= list()

#copying all the data rows with label=0
clean_text_cat_0 = list()
for loop1 in range(0,5000):
    if (((final4['labels'].values)[loop1]) == 0):
        clean_text_cat_0.append(((final4['CleanedText'].values)[loop1]))
clean_text_all_avgw2v.append(clean_text_cat_0)

#copying all the data rows with label=1
clean_text_cat_1 = list()
for loop1 in range(0,5000):
    if (((final4['labels'].values)[loop1]) == 1):
        clean_text_cat_1.append(((final4['CleanedText'].values)[loop1]))
clean_text_all_avgw2v.append(clean_text_cat_1)
```

```
In [343]: wordcloud_print(clean_text_all_avgw2v)
```





```
In [330]: clf_agc_2 = AgglomerativeClustering(n_clusters = 3) #No. clusters = 3
          labels_avgw2v_c3 = clf_agc_2.fit_predict(train_avgw2v_1,y_train_1)
```

In [346]:

```
print(type(labels_avgw2v_c3))
labels_avgw2v_c3_df = pd.DataFrame(labels_avgw2v_c3)
print(type(labels_avgw2v_c3_df))

#matching the number of rows
final3 = final2[0:5000]
print(type(final3))
print(final3.shape)
#final3

#adding the values of labels in the data frame
final4 = final3
print(type(final4))
final4.reindex(columns=[*final4.columns.tolist(), 'labels'],fill_value=1)
final4['labels']=labels_avgw2v_c3_df.values
final4
```

```
<class 'numpy.ndarray'>
<class 'pandas.core.frame.DataFrame'>
<class 'pandas.core.frame.DataFrame'>
(5000, 11)
<class 'pandas.core.frame.DataFrame'>
```

In [347]:

```
clean_text_all_avgw2v= list()

#copying all the data rows with label=0
clean_text_cat_0 = list()
for loop1 in range(0,5000):
    if (((final4['labels'].values)[loop1]) == 0):
        clean_text_cat_0.append(((final4['CleanedText'].values)[loop1]))
clean_text_all_avgw2v.append(clean_text_cat_0)

#copying all the data rows with label=1
clean_text_cat_1 = list()
for loop1 in range(0,5000):
    if (((final4['labels'].values)[loop1]) == 1):
        clean_text_cat_1.append(((final4['CleanedText'].values)[loop1]))
clean_text_all_avgw2v.append(clean_text_cat_1)

#copying all the data rows with label=2
clean_text_cat_2 = list()
for loop1 in range(0,5000):
    if (((final4['labels'].values)[loop1]) == 2):
        clean_text_cat_2.append(((final4['CleanedText'].values)[loop1]))
clean_text_all_avgw2v.append(clean_text_cat_2)
```

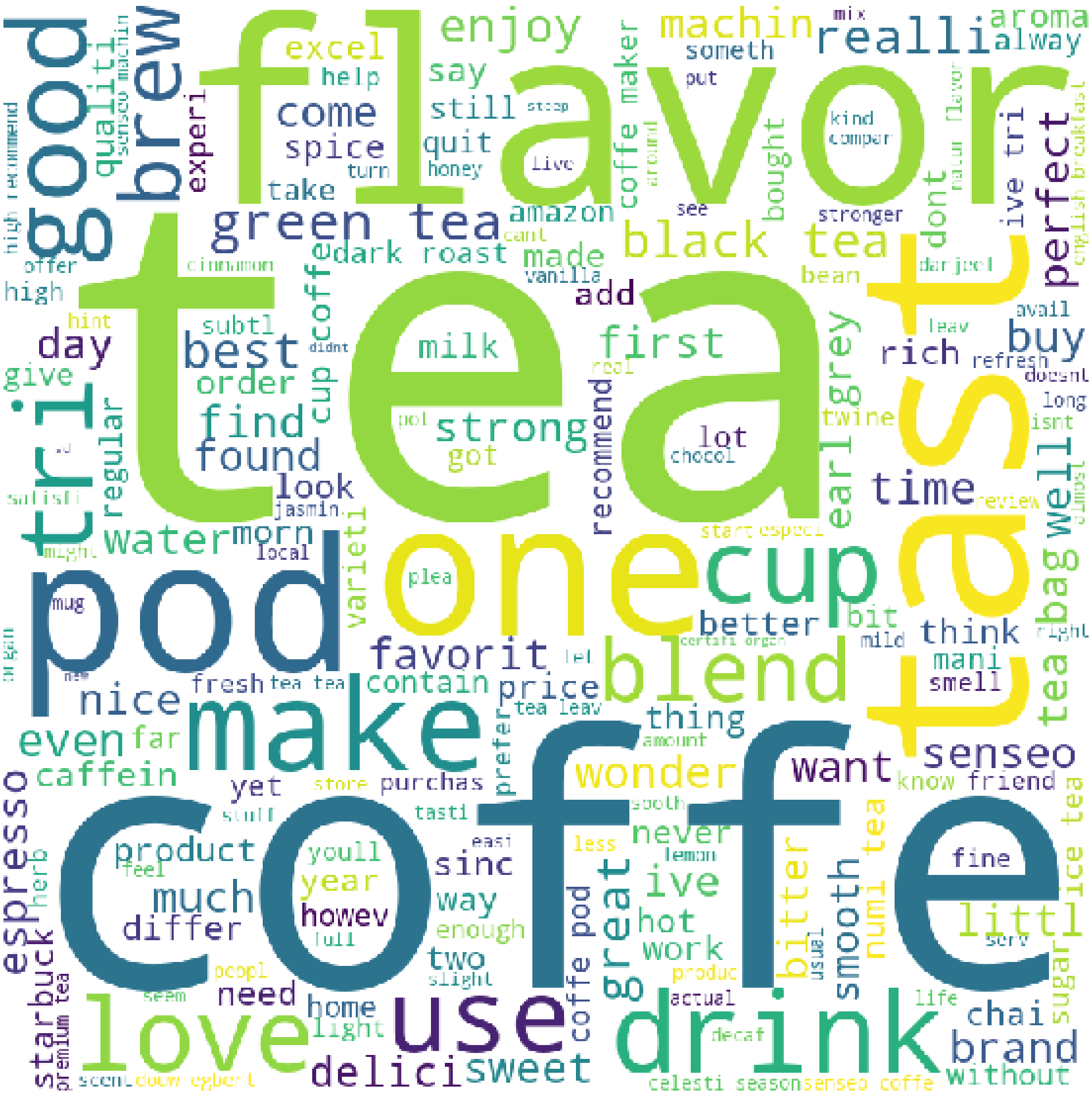
In [348]:

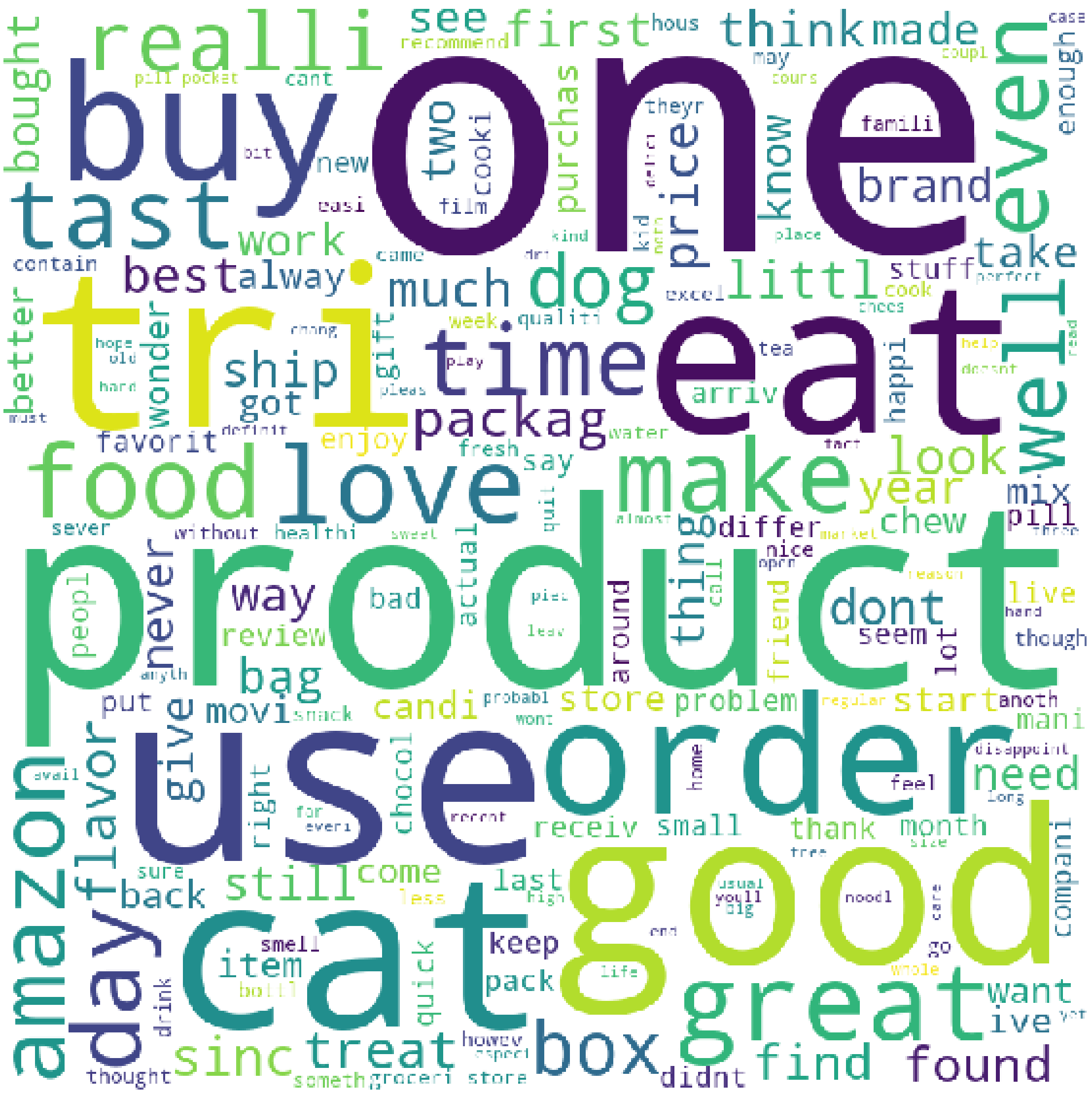
```
print(np.shape(clean_text_all_avgw2v))
```

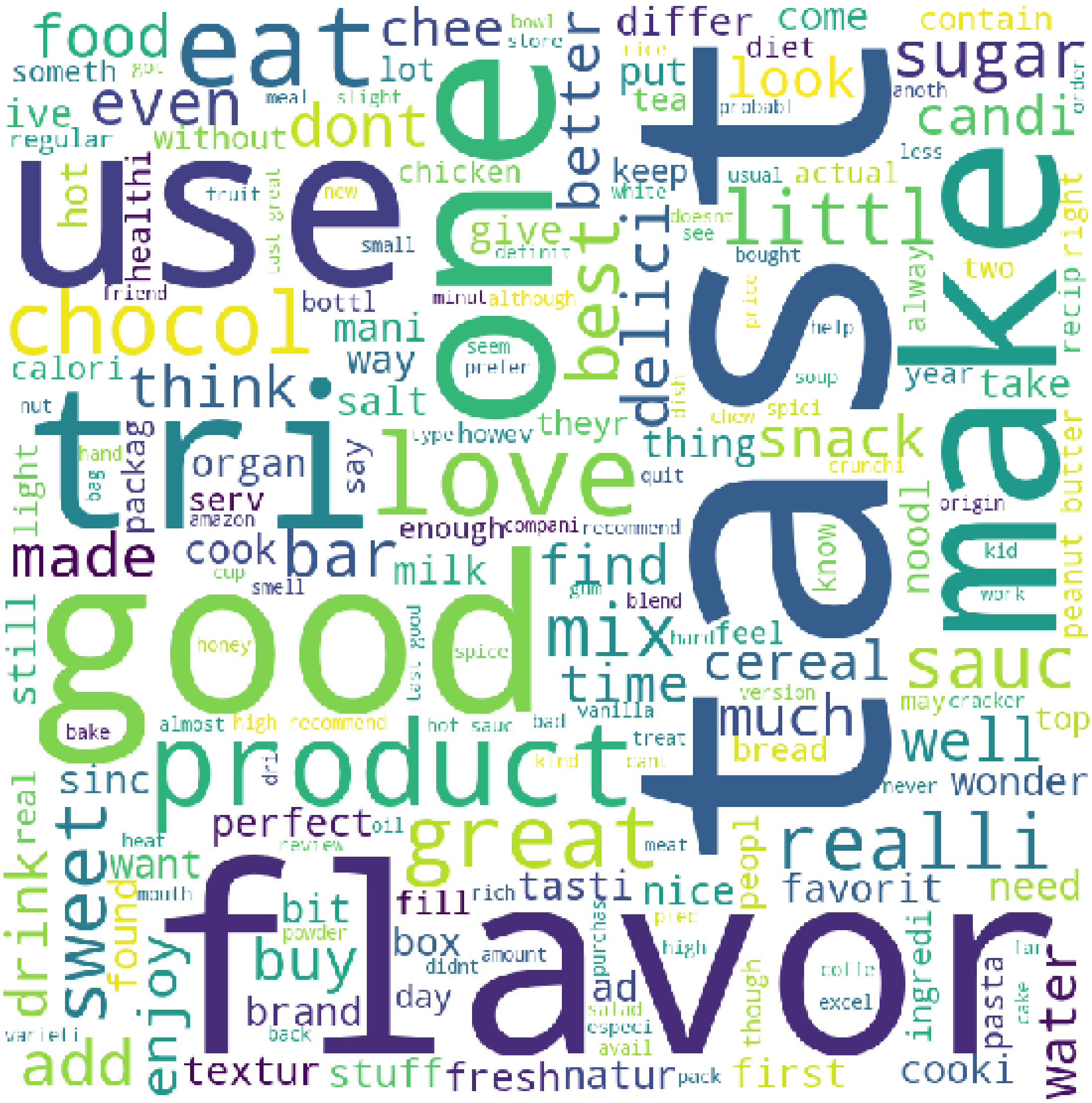
```
(3,)
```

In [349]:

```
wordcloud_print(clean_text_all_avgw2v)
```




product
one
use
good
cat
eat
tri
order
buy
realli
tast
time
love
food
make
great
amazon
day
dog
well
even
box
treat
first
think
made
bought
price
brand
know
take
littl
much
best
work
alway
ship
packag
look
year
chew
mix
pill
way
bad
dont
thing
review
bag
never
still
come
last
item
keep
pack
find
found
sinc
didnt
want
ive
need
receiv
small
thank
month
start
store
problem
candi
movi
give
flavor
back
drink
quick
right
chocol
actual
around
friend
lot
seem
live
though
favorit
enjoy
fresh
say
differ
nice
healthi
without
sever
peopl
put
see
recommend
hous
cant
pill pocket
may
cours
theyr
famili
enough
case
coupl
two
cooki
purchas
new
easi
film
contain
better
wonder
got
gift
week
qualiti
stuff
cook
excel
tea
arriv
happi
water
sure
smell
thought
someth
groceri store
howev
compani
anoth
mani
feel
disappoint
avail



```
In [331]: clf_agc_3 = AgglomerativeClustering(n_clusters = 4) #No. of clusters = 4
          labels_avgw2v_c4 = clf_agc_3.fit_predict(train_avgw2v_1,y_train_1)
```

In [350]:

```
print(type(labels_avgw2v_c4))
labels_avgw2v_c4_df = pd.DataFrame(labels_avgw2v_c4)
print(type(labels_avgw2v_c4_df))

#matching the number of rows
final3 = final2[0:5000]
print(type(final3))
print(final3.shape)
#final3

#adding the values of labels in the data frame
final4 = final3
print(type(final4))
final4.reindex(columns=[*final4.columns.tolist(), 'labels'],fill_value=1)
final4['labels']=labels_avgw2v_c4_df.values
final4
```

```
<class 'numpy.ndarray'>
<class 'pandas.core.frame.DataFrame'>
<class 'pandas.core.frame.DataFrame'>
(5000, 11)
<class 'pandas.core.frame.DataFrame'>
```

In [353]:

```
clean_text_all_avgw2v= list()

#copying all the data rows with label=0
clean_text_cat_0 = list()
for loop1 in range(0,5000):
    if (((final4['labels'].values)[loop1]) == 0):
        clean_text_cat_0.append(((final4['CleanedText'].values)[loop1]))
clean_text_all_avgw2v.append(clean_text_cat_0)

#copying all the data rows with label=1
clean_text_cat_1 = list()
for loop1 in range(0,5000):
    if (((final4['labels'].values)[loop1]) == 1):
        clean_text_cat_1.append(((final4['CleanedText'].values)[loop1]))
clean_text_all_avgw2v.append(clean_text_cat_1)

#copying all the data rows with label=2
clean_text_cat_2 = list()
for loop1 in range(0,5000):
    if (((final4['labels'].values)[loop1]) == 2):
        clean_text_cat_2.append(((final4['CleanedText'].values)[loop1]))
clean_text_all_avgw2v.append(clean_text_cat_2)

#copying all the data rows with label=3
clean_text_cat_3 = list()
for loop1 in range(0,5000):
    if (((final4['labels'].values)[loop1]) == 3):
        clean_text_cat_3.append(((final4['CleanedText'].values)[loop1]))
clean_text_all_avgw2v.append(clean_text_cat_3)
```

In [354]:

```
print(np.shape(clean_text_all_avgw2v))
```

```
(4,)
```

In [355]:

```
wordcloud_print(clean_text_all_avgw2v)
```

In [332]:

```
clf_agc_4 = AgglomerativeClustering(n_clusters = 5) #No. of clusters = 5
labels_avgw2v_c5 = clf_agc_4.fit_predict(train_avgw2v_1,y_train_1)
```

In [356]:

```
print(type(labels_avgw2v_c5))
labels_avgw2v_c5_df = pd.DataFrame(labels_avgw2v_c5)
print(type(labels_avgw2v_c5_df))

#matching the number of rows
final3 = final2[0:5000]
print(type(final3))
print(final3.shape)
#final3

#adding the values of labels in the data frame
final4 = final3
print(type(final4))
final4.reindex(columns=[*final4.columns.tolist(), 'labels'],fill_value=1)
final4['labels']=labels_avgw2v_c5_df.values
final4
```

```
<class 'numpy.ndarray'>
<class 'pandas.core.frame.DataFrame'>
<class 'pandas.core.frame.DataFrame'>
(5000, 11)
<class 'pandas.core.frame.DataFrame'>
```

In [357]:

```
clean_text_all_avgw2v= list()

#copying all the data rows with label=0
clean_text_cat_0 = list()
for loop1 in range(0,5000):
    if (((final4['labels'].values)[loop1]) == 0):
        clean_text_cat_0.append(((final4['CleanedText'].values)[loop1]))
clean_text_all_avgw2v.append(clean_text_cat_0)

#copying all the data rows with label=1
clean_text_cat_1 = list()
for loop1 in range(0,5000):
    if (((final4['labels'].values)[loop1]) == 1):
        clean_text_cat_1.append(((final4['CleanedText'].values)[loop1]))
clean_text_all_avgw2v.append(clean_text_cat_1)

#copying all the data rows with label=2
clean_text_cat_2 = list()
for loop1 in range(0,5000):
    if (((final4['labels'].values)[loop1]) == 2):
        clean_text_cat_2.append(((final4['CleanedText'].values)[loop1]))
clean_text_all_avgw2v.append(clean_text_cat_2)

#copying all the data rows with label=3
clean_text_cat_3 = list()
for loop1 in range(0,5000):
    if (((final4['labels'].values)[loop1]) == 3):
        clean_text_cat_3.append(((final4['CleanedText'].values)[loop1]))
clean_text_all_avgw2v.append(clean_text_cat_3)

#copying all the data rows with label=4
clean_text_cat_4 = list()
for loop1 in range(0,5000):
    if (((final4['labels'].values)[loop1]) == 4):
        clean_text_cat_4.append(((final4['CleanedText'].values)[loop1]))
clean_text_all_avgw2v.append(clean_text_cat_4)
```

In [358]:

```
print(np.shape(clean_text_all_avgw2v))
```

```
(5,)
```

In [359]:
```
wordcloud_print(clean_text_all_avgw2v)
```

smell
cracker
almost
didnt
product
one
wonder
minut
tea
mani
eat
day
two
friend
back
look
sauc
gum
want
way
soup
type
stuff
recip
time
delici
order
thing
spice
new
kind
hot
help
especi
sugar
keep
prefer
tast
enjoy
salt
bowl
dish
bag
rice
cereal
much
great
cooki
come
recommend
think
bit
kid
bought
alway
peopl
chicken
favorit
chees
still
calori
honey
sinc
origin
probabl
vanilla
well
although
mouth
price
pasta
high recommend
white
cake
right
tasti
got
textur
hand
far
doesnt
sweet
made
make
bar
found
bottl
without
meal
hot sauc
slight
store
small
find
piec
best
fruit
hard
need
peanut butter
natur
fresh
crunchi
howev
someth
year
seem
less
enough
powder
ad
know
quit
anoth
lot
real
flavor

Agglomerative Clustering on tfidf-W-W2V

In [360]:
```
clf_agc_1_tfidfww2v = AgglomerativeClustering(n_clusters = 2) #No. of clusters =
labels_tfidfww2v_c2 = clf_agc_1_tfidfww2v.fit_predict(train_tfidfww2v_1,y_train_
```

In [362]:

```
print(type(labels_tfidfww2v_c2))
labels_tfidfww2v_c2_df = pd.DataFrame(labels_tfidfww2v_c2)
print(type(labels_tfidfww2v_c2_df))

#matching the number of rows
final3 = final2[0:5000]
print(type(final3))
print(final3.shape)
#final3

#adding the values of labels in the data frame
final4 = final3
print(type(final4))
final4.reindex(columns=[*final4.columns.tolist(), 'labels'],fill_value=1)
final4['labels']=labels_tfidfww2v_c2_df.values
final4
```

```
<class 'numpy.ndarray'>
<class 'pandas.core.frame.DataFrame'>
<class 'pandas.core.frame.DataFrame'>
(5000, 11)
<class 'pandas.core.frame.DataFrame'>
```

In [363]:

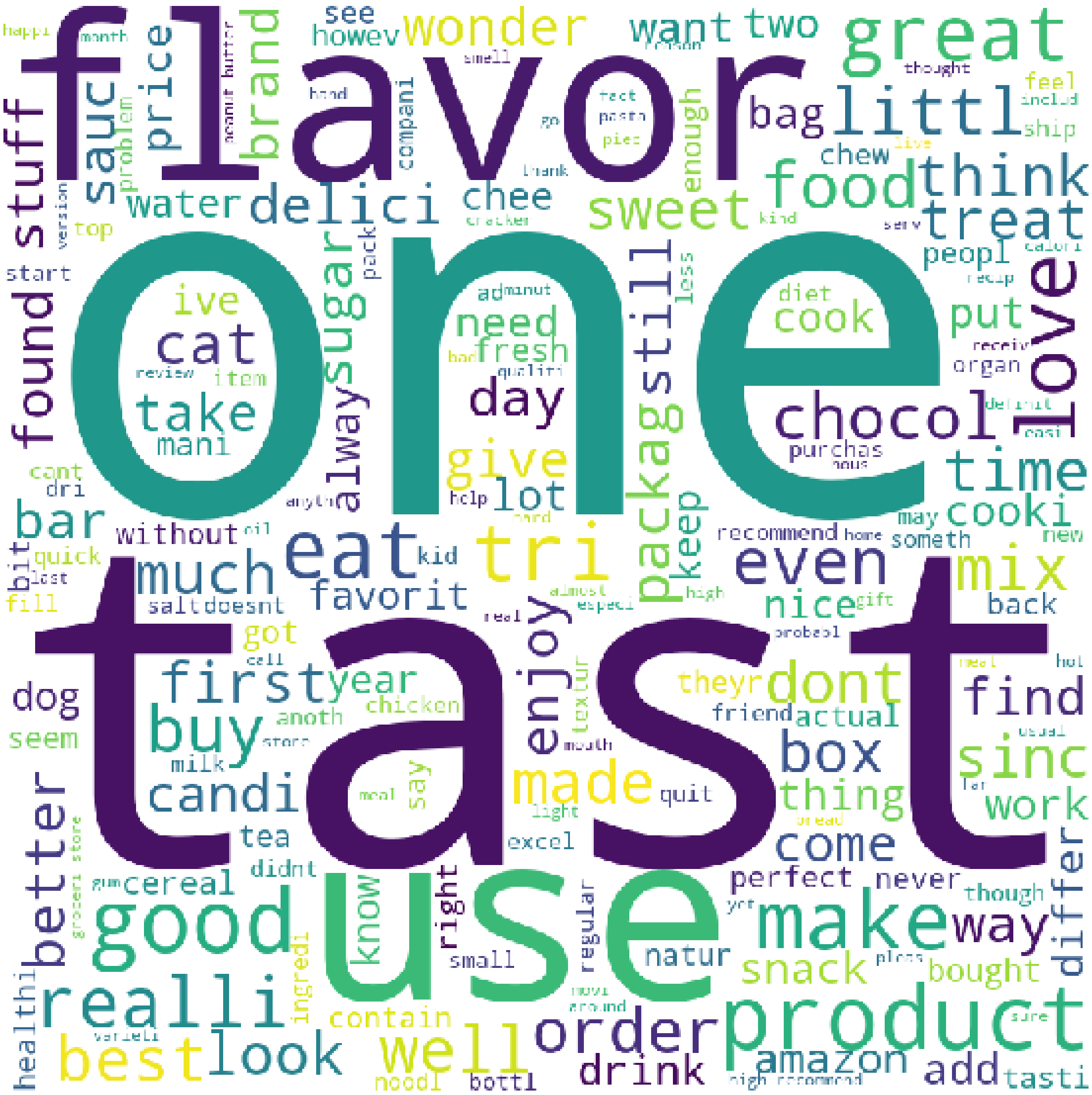
```
clean_text_all_tfidfww2v = list()

#copying all the data rows with label=0
clean_text_cat_0 = list()
for loop1 in range(0,5000):
    if (((final4['labels'].values)[loop1]) == 0):
        clean_text_cat_0.append(((final4['CleanedText'].values)[loop1]))
clean_text_all_tfidfww2v.append(clean_text_cat_0)

#copying all the data rows with label=1
clean_text_cat_1 = list()
for loop1 in range(0,5000):
    if (((final4['labels'].values)[loop1]) == 1):
        clean_text_cat_1.append(((final4['CleanedText'].values)[loop1]))
clean_text_all_tfidfww2v.append(clean_text_cat_1)
```

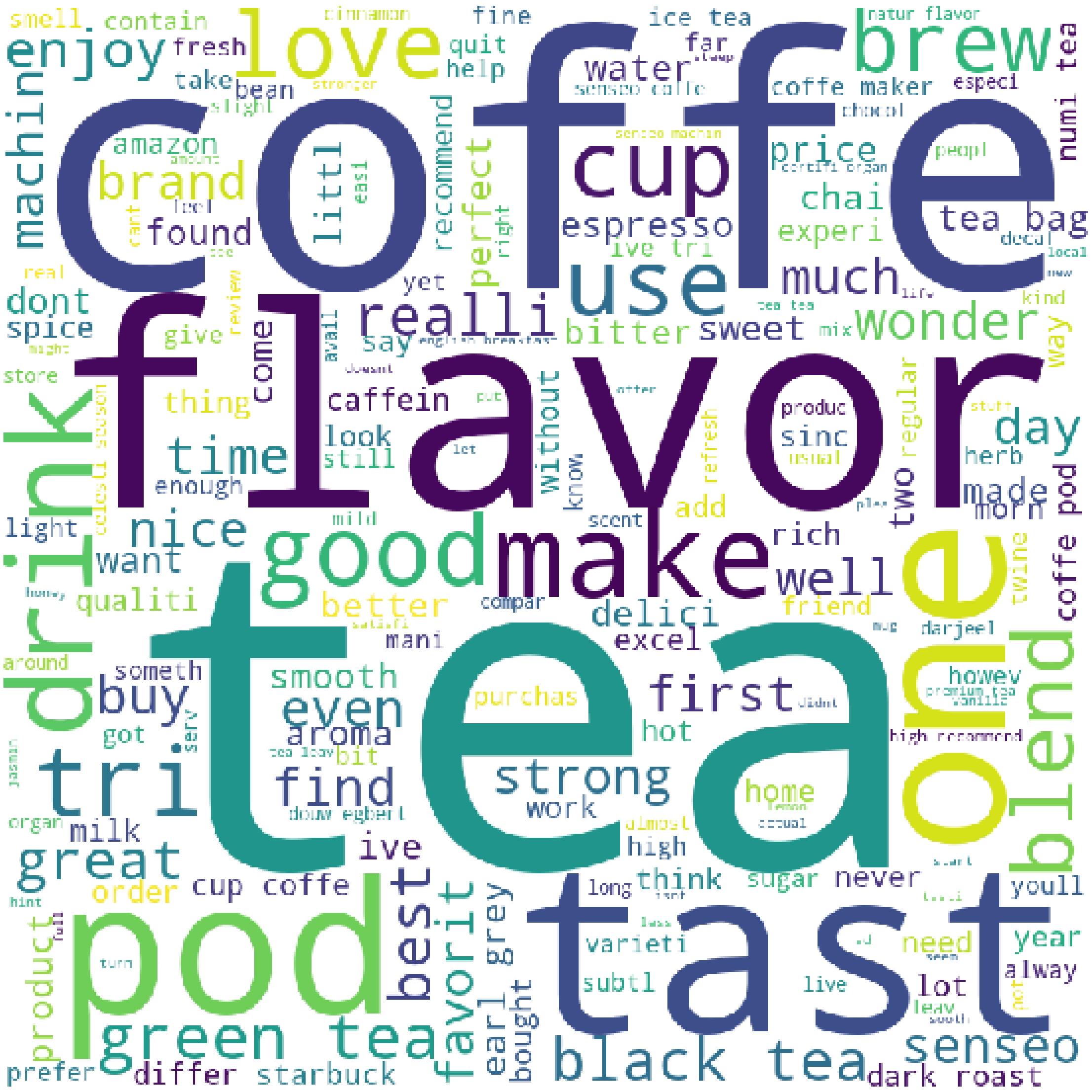
In [364]:

```
print(np.shape(clean_text_all_tfidfww2v))
```

```
(2,)
```

```
In [365]: wordcloud_print(clean_text_all_tfidfww2v)
```





```
In [367]: clf_agc_2_tfidfww2v = AgglomerativeClustering(n_clusters = 3) #No. of clusters =
          labels_tfidfww2v_c3 = clf_agc_2_tfidfww2v.fit_predict(train_tfidfww2v_1,y_train_
```

In [368]:

```
print(type(labels_tfidfww2v_c3))
labels_tfidfww2v_c3_df = pd.DataFrame(labels_tfidfww2v_c3)
print(type(labels_tfidfww2v_c3_df))

#matching the number of rows
final3 = final2[0:5000]
print(type(final3))
print(final3.shape)
#final3

#adding the values of labels in the data frame
final4 = final3
print(type(final4))
final4.reindex(columns=[*final4.columns.tolist(), 'labels'],fill_value=1)
final4['labels']=labels_tfidfww2v_c3_df.values
final4
```

```
<class 'numpy.ndarray'>
<class 'pandas.core.frame.DataFrame'>
<class 'pandas.core.frame.DataFrame'>
(5000, 11)
<class 'pandas.core.frame.DataFrame'>
```

In [369]:

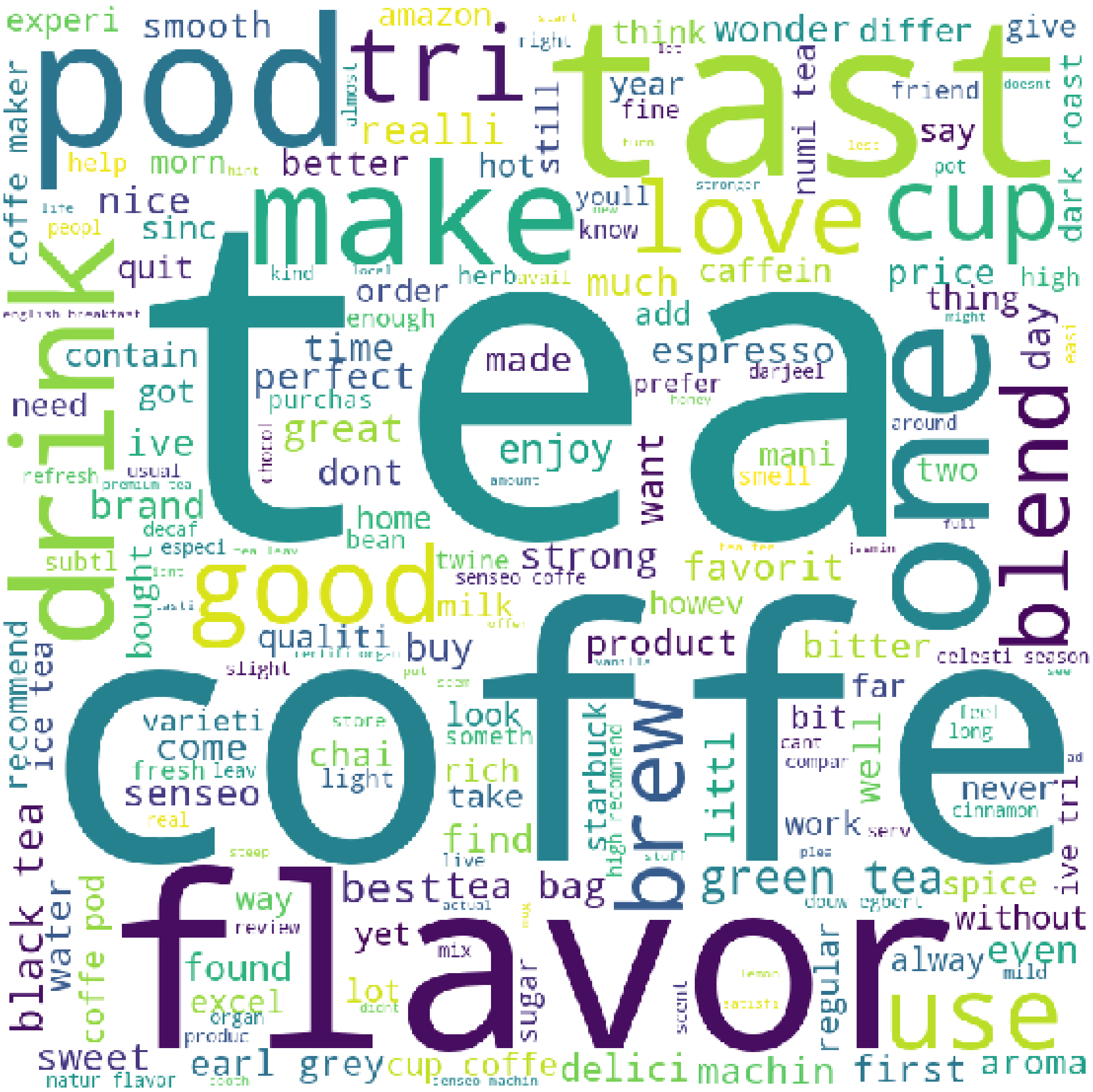
```
clean_text_all_tfidfww2v = list()

#copying all the data rows with label=0
clean_text_cat_0 = list()
for loop1 in range(0,5000):
    if (((final4['labels'].values)[loop1]) == 0):
        clean_text_cat_0.append(((final4['CleanedText'].values)[loop1]))
clean_text_all_tfidfww2v.append(clean_text_cat_0)

#copying all the data rows with label=1
clean_text_cat_1 = list()
for loop1 in range(0,5000):
    if (((final4['labels'].values)[loop1]) == 1):
        clean_text_cat_1.append(((final4['CleanedText'].values)[loop1]))
clean_text_all_tfidfww2v.append(clean_text_cat_1)

#copying all the data rows with label=2
clean_text_cat_2 = list()
for loop1 in range(0,5000):
    if (((final4['labels'].values)[loop1]) == 2):
        clean_text_cat_2.append(((final4['CleanedText'].values)[loop1]))
clean_text_all_tfidfww2v.append(clean_text_cat_2)
```

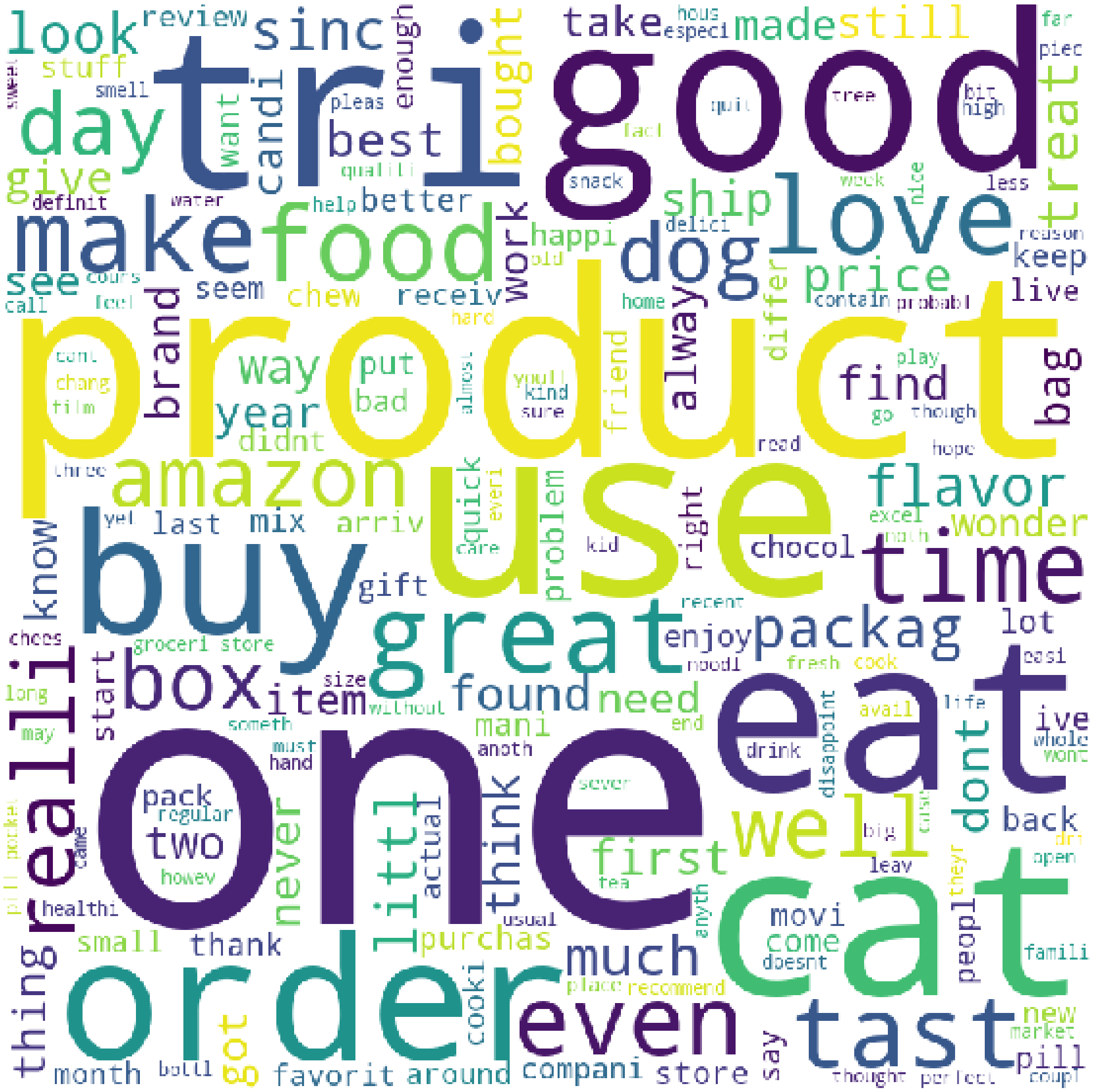
In [370]:

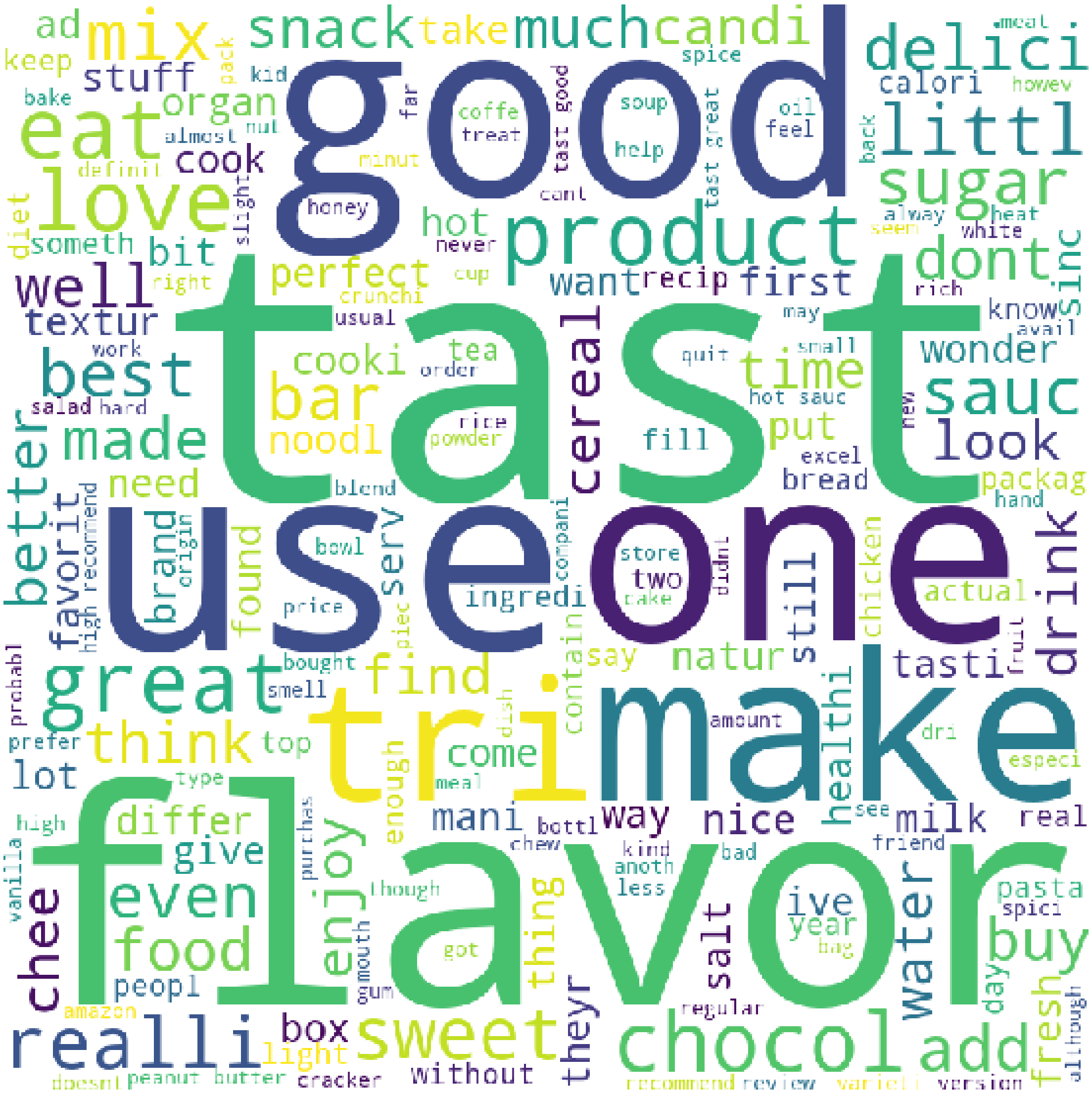
```
print(np.shape(clean_text_all_tfidfww2v))
```

```
(3,)
```

In [371]:
```
wordcloud_print(clean_text_all_tfidfww2v)
```




product
one
use
good
tri
buy
eat
cat
order
great
love
make
food
dog
time
even
tast
realli
day
look
sinc
amazon
box
well
first
much
price
flavor
treat
best
bought
take
made
still
give
ship
packag
find
year
way
put
bad
brand
item
found
need
know
think
littl
never
two
pack
chocol
wonder
bag
keep
live
seem
chew
receiv
work
happi
alway
differ
friend
right
quick
problem
gift
last
mix
arriv
didnt
candi
want
enough
better
review
stuff
smell
pleas
qualiti
see
call
feel
definit
water
help
cours
snack
delici
home
contain
probabl
hard
hous
especi
far
piec
bit
high
quit
tree
fact
week
nice
less
reason
old
play
though
go
hope
read
youll
kind
sure
almost
everi
care
kid
excel
noth
chang
film
three
yet
recent
enjoy
noodl
fresh
cook
lot
easi
life
ive
whole
wont
drink
disappoint
dont
back
dri
open
big
leav
also
theyr
peopl
sever
tea
movi
come
doesnt
famili
new
market
pill
coupl
store
compani
around
favorit
month
bottl
got
cooki
purchas
place
recommend
say
thought
perfect
thing
small
thank
healthi
usual
anyth
actual
mani
anoth
must
hand
someth
without
size
start
long
may
chees
groceri store
regular
howev
came
pill pocket
sweet
cont
mani



```
In [372]: clf_agc_3_tfidfww2v = AgglomerativeClustering(n_clusters = 4) #No. of clusters =
          labels_tfidfww2v_c4 = clf_agc_3_tfidfww2v.fit_predict(train_tfidfww2v_1,y_train_
```

In [373]:

```
print(type(labels_tfidfww2v_c4))
labels_tfidfww2v_c4_df = pd.DataFrame(labels_tfidfww2v_c4)
print(type(labels_tfidfww2v_c4_df))

#matching the number of rows
final3 = final2[0:5000]
print(type(final3))
print(final3.shape)
#final3

#adding the values of labels in the data frame
final4 = final3
print(type(final4))
final4.reindex(columns=[*final4.columns.tolist(), 'labels'],fill_value=1)
final4['labels']=labels_tfidfww2v_c4_df.values
final4
```

```
<class 'numpy.ndarray'>
<class 'pandas.core.frame.DataFrame'>
<class 'pandas.core.frame.DataFrame'>
(5000, 11)
<class 'pandas.core.frame.DataFrame'>
```

In [374]:

```
clean_text_all_tfidfww2v = list()

#copying all the data rows with label=0
clean_text_cat_0 = list()
for loop1 in range(0,5000):
    if (((final4['labels'].values)[loop1]) == 0):
        clean_text_cat_0.append(((final4['CleanedText'].values)[loop1]))
clean_text_all_tfidfww2v.append(clean_text_cat_0)

#copying all the data rows with label=1
clean_text_cat_1 = list()
for loop1 in range(0,5000):
    if (((final4['labels'].values)[loop1]) == 1):
        clean_text_cat_1.append(((final4['CleanedText'].values)[loop1]))
clean_text_all_tfidfww2v.append(clean_text_cat_1)

#copying all the data rows with label=2
clean_text_cat_2 = list()
for loop1 in range(0,5000):
    if (((final4['labels'].values)[loop1]) == 2):
        clean_text_cat_2.append(((final4['CleanedText'].values)[loop1]))
clean_text_all_tfidfww2v.append(clean_text_cat_2)

#copying all the data rows with label=3
clean_text_cat_3 = list()
for loop1 in range(0,5000):
    if (((final4['labels'].values)[loop1]) == 3):
        clean_text_cat_3.append(((final4['CleanedText'].values)[loop1]))
clean_text_all_tfidfww2v.append(clean_text_cat_3)
```

In [375]:

```
print(np.shape(clean_text_all_tfidfww2v))
```

```
(4,)
```

In [376]:

```
wordcloud_print(clean_text_all_tfidfww2v)
```

Applying DBSCAN on avgW2V

In [377]:

```
clf_dbs_1 = DBSCAN(eps=3)
labels_avgw2v_e1 = clf_dbs_1.fit_predict(train_avgw2v_1,y_train_1)
```

In [381]:

```
print(type(labels_avgw2v_e1))
labels_avgw2v_e1_df = pd.DataFrame(labels_avgw2v_e1)
print(type(labels_avgw2v_e1_df))

#matching the number of rows
final3 = final2[0:5000]
print(type(final3))
print(final3.shape)
#final3

#adding the values of labels in the data frame
final4 = final3
print(type(final4))
final4.reindex(columns=[*final4.columns.tolist(), 'labels'],fill_value=1)
final4['labels']=labels_avgw2v_e1_df.values

n_clusters_ = len(set(labels_avgw2v_e1)) - (1 if -1 in labels_avgw2v_e1 else 0)
print ("No. of clusters formed = ",n_clusters_)

final4
```

```
<class 'numpy.ndarray'>
<class 'pandas.core.frame.DataFrame'>
<class 'pandas.core.frame.DataFrame'>
(5000, 11)
<class 'pandas.core.frame.DataFrame'>
No. of clusters formed =  1
```

In [382]:

```
clean_text_all_avgw2v= list()

#copying all the data rows with label=0
clean_text_cat_0 = list()
for loop1 in range(0,5000):
    if (((final4['labels'].values)[loop1]) == 0):
        clean_text_cat_0.append(((final4['CleanedText'].values)[loop1]))
clean_text_all_avgw2v.append(clean_text_cat_0)
```

In [383]:
```
print(np.shape(clean_text_all_avgw2v))
```

```
(1, 4457)
```

In [384]:
```
wordcloud_print(clean_text_all_avgw2v)
```

know
may
flavor
add
sweet
ive
delici
back
around
year
organ
yet
bad
sinc
tri
food
prefer
feel
water
brew
enjoy
qualiti
nice
start
peopl
quick
right
hand
recip
might
regular
home
treat
milk
got
go
cant
bit
price
bag
bottl
spice
see
even
great
brand
though
first
stuff
pod
less
fresh
serv
put
item
seem
chocol
alway
come
sauc
snack
buy
hot
cooki
amazon
review
bar
ship
definit
time
best
pack
didnt
real
differ
tea
blend
kind
enough
lot
top
diet
new
store
say
find
green tea
cat
wonder
eat
chew
high
chee
ad
strong
keep
dont
want
light
actual
sugar
packag
take
healthi
make
tast
use
love
good
much
far
call
give
help
think
tasti
someth
natur
anoth
better
found
doesnt
coffe
dri
minut
one
drink
textur
purchas
live
thought
howev
varieti
perfect
compani
fill
smell
contain
cup
still
mix
need
order
look
never
dog
especi
thing
way
without
excel
thank
theyr
product
work
gift
littl
favorit
usual
quit
probabl
two
candi
avail
mani
salt
cereal
kid
box
made
day
realli
well
recommend
bought
cook
friend
problem
reason
small
ingredi
last
chicken

In [385]:
```
clf_dbs_2 = DBSCAN(eps=2)
labels_avgw2v_e2 = clf_dbs_2.fit_predict(train_avgw2v_1,y_train_1)
```

In [386]:

```
print(type(labels_avgw2v_e2))
labels_avgw2v_e2_df = pd.DataFrame(labels_avgw2v_e2)
print(type(labels_avgw2v_e2_df))

#matching the number of rows
final3 = final2[0:5000]
print(type(final3))
print(final3.shape)
#final3

#adding the values of labels in the data frame
final4 = final3
print(type(final4))
final4.reindex(columns=[*final4.columns.tolist(), 'labels'],fill_value=1)
final4['labels']=labels_avgw2v_e2_df.values

n_clusters_ = len(set(labels_avgw2v_e2)) - (1 if -1 in labels_avgw2v_e2 else 0)
print ("No. of clusters formed = ",n_clusters_)

final4
```

```
<class 'numpy.ndarray'>
<class 'pandas.core.frame.DataFrame'>
<class 'pandas.core.frame.DataFrame'>
(5000, 11)
<class 'pandas.core.frame.DataFrame'>
No. of clusters formed =  12
```

In [388]:

```
clean_text_all_avgw2v = list()

#copying all the data rows with label=0
clean_text_cat_0 = list()
for loop1 in range(0,5000):
    if (((final4['labels'].values)[loop1]) == 0):
        clean_text_cat_0.append(((final4['CleanedText'].values)[loop1]))
clean_text_all_avgw2v.append(clean_text_cat_0)

#copying all the data rows with label=1
clean_text_cat_1 = list()
for loop1 in range(0,5000):
    if (((final4['labels'].values)[loop1]) == 1):
        clean_text_cat_1.append(((final4['CleanedText'].values)[loop1]))
clean_text_all_avgw2v.append(clean_text_cat_1)

#copying all the data rows with label=2
clean_text_cat_2 = list()
for loop1 in range(0,5000):
    if (((final4['labels'].values)[loop1]) == 2):
        clean_text_cat_2.append(((final4['CleanedText'].values)[loop1]))
clean_text_all_avgw2v.append(clean_text_cat_2)

#copying all the data rows with label=3
clean_text_cat_3 = list()
for loop1 in range(0,5000):
    if (((final4['labels'].values)[loop1]) == 3):
        clean_text_cat_3.append(((final4['CleanedText'].values)[loop1]))
clean_text_all_avgw2v.append(clean_text_cat_3)

#copying all the data rows with label=4
clean_text_cat_4 = list()
for loop1 in range(0,5000):
    if (((final4['labels'].values)[loop1]) == 4):
        clean_text_cat_4.append(((final4['CleanedText'].values)[loop1]))
clean_text_all_avgw2v.append(clean_text_cat_4)

#copying all the data rows with label=5
clean_text_cat_5 = list()
for loop1 in range(0,5000):
    if (((final4['labels'].values)[loop1]) == 5):
        clean_text_cat_5.append(((final4['CleanedText'].values)[loop1]))
clean_text_all_avgw2v.append(clean_text_cat_5)

#copying all the data rows with label=6
clean_text_cat_6 = list()
for loop1 in range(0,5000):
    if (((final4['labels'].values)[loop1]) == 6):
        clean_text_cat_6.append(((final4['CleanedText'].values)[loop1]))
clean_text_all_avgw2v.append(clean_text_cat_6)

#copying all the data rows with label=7
clean_text_cat_7 = list()
for loop1 in range(0,5000):
    if (((final4['labels'].values)[loop1]) == 7):
        clean_text_cat_7.append(((final4['CleanedText'].values)[loop1]))
```

```
clean_text_all_avgw2v.append(clean_text_cat_7)

#copying all the data rows with label=8
clean_text_cat_8 = list()
for loop1 in range(0,5000):
    if (((final4['labels'].values)[loop1]) == 8):
        clean_text_cat_8.append(((final4['CleanedText'].values)[loop1]))
clean_text_all_avgw2v.append(clean_text_cat_8)

#copying all the data rows with label=9
clean_text_cat_9 = list()
for loop1 in range(0,5000):
    if (((final4['labels'].values)[loop1]) == 9):
        clean_text_cat_9.append(((final4['CleanedText'].values)[loop1]))
clean_text_all_avgw2v.append(clean_text_cat_9)

#copying all the data rows with label=10
clean_text_cat_10 = list()
for loop1 in range(0,5000):
    if (((final4['labels'].values)[loop1]) == 10):
        clean_text_cat_10.append(((final4['CleanedText'].values)[loop1]))
clean_text_all_avgw2v.append(clean_text_cat_10)

#copying all the data rows with label=11
clean_text_cat_11 = list()
for loop1 in range(0,5000):
    if (((final4['labels'].values)[loop1]) == 11):
        clean_text_cat_11.append(((final4['CleanedText'].values)[loop1]))
clean_text_all_avgw2v.append(clean_text_cat_11)
```

In [389]:

```
print(np.shape(clean_text_all_avgw2v))
```

```
(13,)
```

In [390]:

```
wordcloud_print(clean_text_all_avgw2v)
```

In [391]:

```
clf_dbs_3 = DBSCAN(eps=1)
labels_avgw2v_e3 = clf_dbs_3.fit_predict(train_avgw2v_1,y_train_1)
```

In [392]:

```
print(type(labels_avgw2v_e3))
labels_avgw2v_e3_df = pd.DataFrame(labels_avgw2v_e3)
print(type(labels_avgw2v_e3_df))

#matching the number of rows
final3 = final2[0:5000]
print(type(final3))
print(final3.shape)
#final3

#adding the values of labels in the data frame
final4 = final3
print(type(final4))
final4.reindex(columns=[*final4.columns.tolist(), 'labels'],fill_value=1)
final4['labels']=labels_avgw2v_e3_df.values

n_clusters_ = len(set(labels_avgw2v_e3)) - (1 if -1 in labels_avgw2v_e3 else 0)
print ("No. of clusters formed = ",n_clusters_)

final4
```

```
<class 'numpy.ndarray'>
<class 'pandas.core.frame.DataFrame'>
<class 'pandas.core.frame.DataFrame'>
(5000, 11)
<class 'pandas.core.frame.DataFrame'>
No. of clusters formed =  8
```

In [393]:

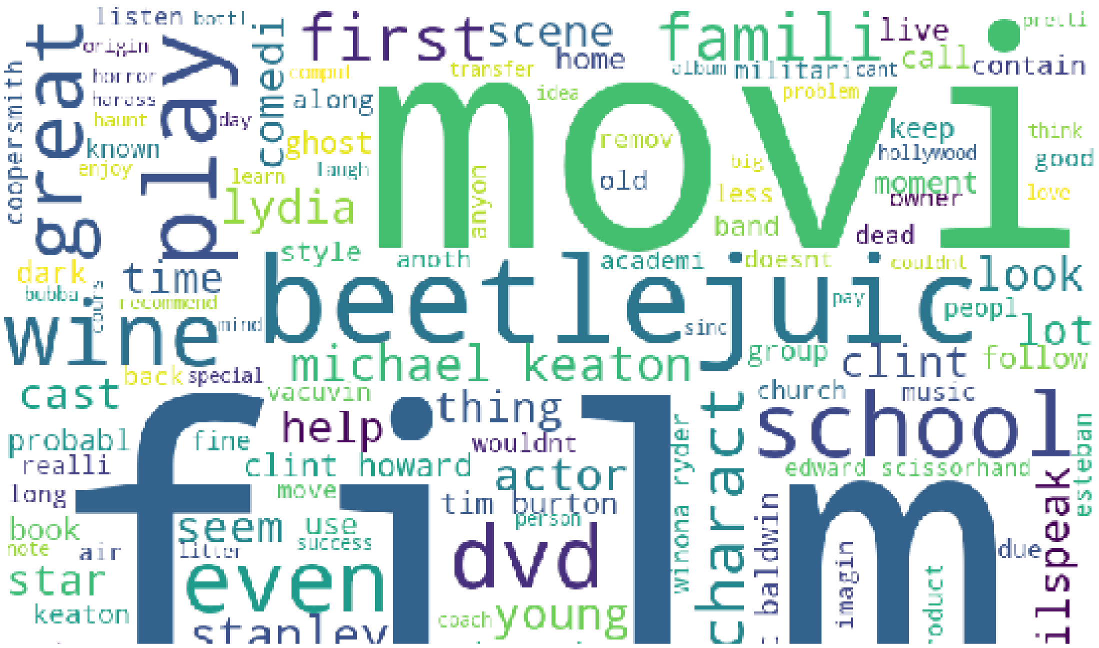
```
clean_text_all_avgw2v = list()

#copying all the data rows with label=0
clean_text_cat_0 = list()
for loop1 in range(0,5000):
    if (((final4['labels'].values)[loop1]) == 0):
        clean_text_cat_0.append(((final4['CleanedText'].values)[loop1]))
clean_text_all_avgw2v.append(clean_text_cat_0)

#copying all the data rows with label=1
clean_text_cat_1 = list()
for loop1 in range(0,5000):
    if (((final4['labels'].values)[loop1]) == 1):
        clean_text_cat_1.append(((final4['CleanedText'].values)[loop1]))
clean_text_all_avgw2v.append(clean_text_cat_1)

#copying all the data rows with label=2
clean_text_cat_2 = list()
for loop1 in range(0,5000):
    if (((final4['labels'].values)[loop1]) == 2):
        clean_text_cat_2.append(((final4['CleanedText'].values)[loop1]))
clean_text_all_avgw2v.append(clean_text_cat_2)

#copying all the data rows with label=3
clean_text_cat_3 = list()
for loop1 in range(0,5000):
    if (((final4['labels'].values)[loop1]) == 3):
        clean_text_cat_3.append(((final4['CleanedText'].values)[loop1]))
clean_text_all_avgw2v.append(clean_text_cat_3)

#copying all the data rows with label=4
clean_text_cat_4 = list()
for loop1 in range(0,5000):
    if (((final4['labels'].values)[loop1]) == 4):
        clean_text_cat_4.append(((final4['CleanedText'].values)[loop1]))
clean_text_all_avgw2v.append(clean_text_cat_4)

#copying all the data rows with label=5
clean_text_cat_5 = list()
for loop1 in range(0,5000):
    if (((final4['labels'].values)[loop1]) == 5):
        clean_text_cat_5.append(((final4['CleanedText'].values)[loop1]))
clean_text_all_avgw2v.append(clean_text_cat_5)

#copying all the data rows with label=6
clean_text_cat_6 = list()
for loop1 in range(0,5000):
    if (((final4['labels'].values)[loop1]) == 6):
        clean_text_cat_6.append(((final4['CleanedText'].values)[loop1]))
clean_text_all_avgw2v.append(clean_text_cat_6)

#copying all the data rows with label=7
clean_text_cat_7 = list()
for loop1 in range(0,5000):
    if (((final4['labels'].values)[loop1]) == 7):
        clean_text_cat_7.append(((final4['CleanedText'].values)[loop1]))
```

```
clean_text_all_avgw2v.append(clean_text_cat_7)
```

In [394]:
```
print(np.shape(clean_text_all_avgw2v))
```

```
(8,)
```

In [395]:
```
wordcloud_print(clean_text_all_avgw2v)
```



In [396]:
```
clf_dbs_4 = DBSCAN(eps=0.5)
labels_avgw2v_e4 = clf_dbs_4.fit_predict(train_avgw2v_1,y_train_1)
```

In [397]:

```
print(type(labels_avgw2v_e4))
labels_avgw2v_e4_df = pd.DataFrame(labels_avgw2v_e4)
print(type(labels_avgw2v_e4_df))

#matching the number of rows
final3 = final2[0:5000]
print(type(final3))
print(final3.shape)
#final3

#adding the values of labels in the data frame
final4 = final3
print(type(final4))
final4.reindex(columns=[*final4.columns.tolist(), 'labels'],fill_value=1)
final4['labels']=labels_avgw2v_e4_df.values

n_clusters_ = len(set(labels_avgw2v_e4)) - (1 if -1 in labels_avgw2v_e4 else 0)
print ("No. of clusters formed = ",n_clusters_)

final4
```

```
<class 'numpy.ndarray'>
<class 'pandas.core.frame.DataFrame'>
<class 'pandas.core.frame.DataFrame'>
(5000, 11)
<class 'pandas.core.frame.DataFrame'>
No. of clusters formed =  2
```

In [398]:

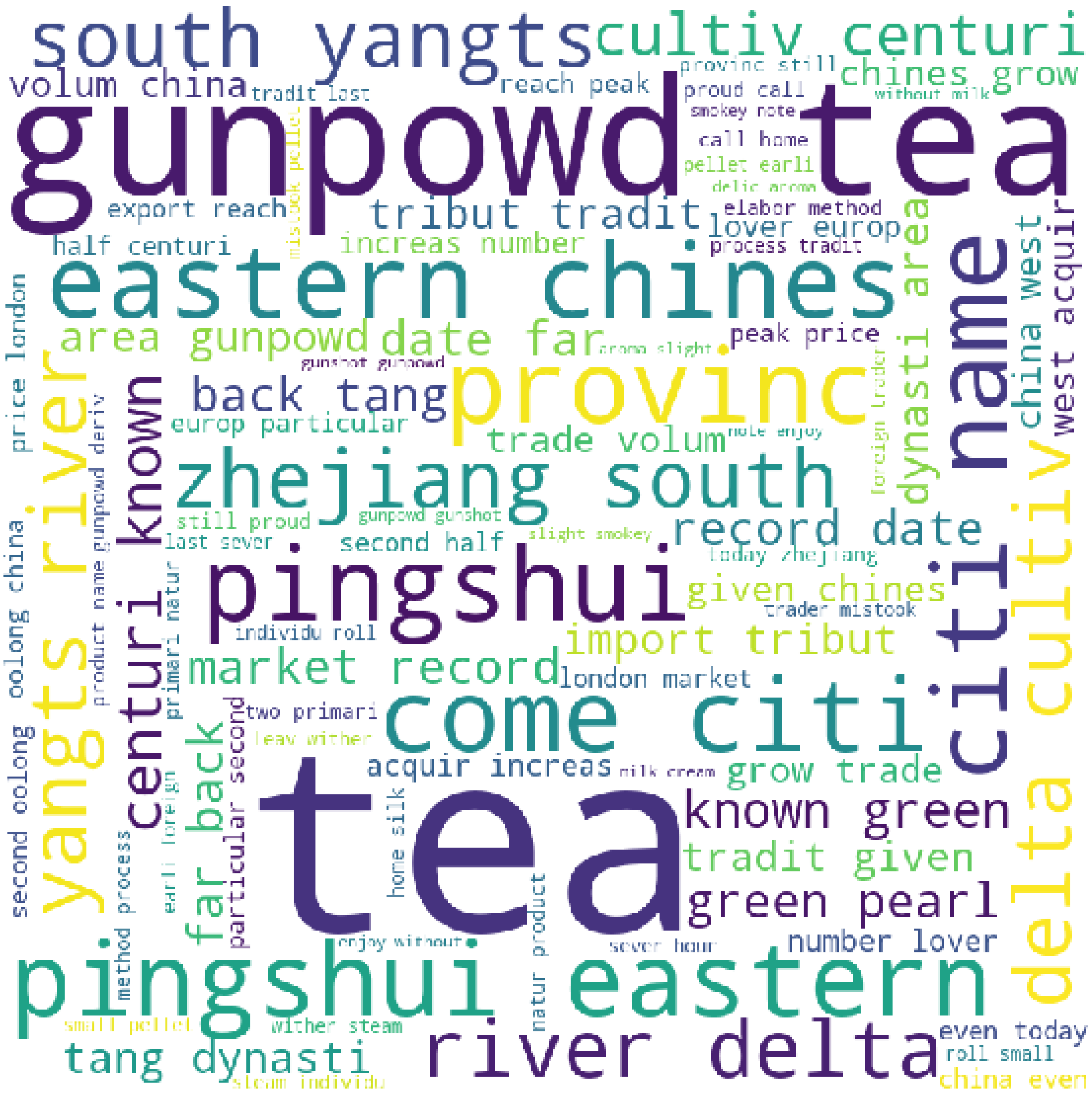
```
clean_text_all_avgw2v = list()

#copying all the data rows with label=0
clean_text_cat_0 = list()
for loop1 in range(0,5000):
    if (((final4['labels'].values)[loop1]) == 0):
        clean_text_cat_0.append(((final4['CleanedText'].values)[loop1]))
clean_text_all_avgw2v.append(clean_text_cat_0)

#copying all the data rows with label=1
clean_text_cat_1 = list()
for loop1 in range(0,5000):
    if (((final4['labels'].values)[loop1]) == 1):
        clean_text_cat_1.append(((final4['CleanedText'].values)[loop1]))
clean_text_all_avgw2v.append(clean_text_cat_1)
```

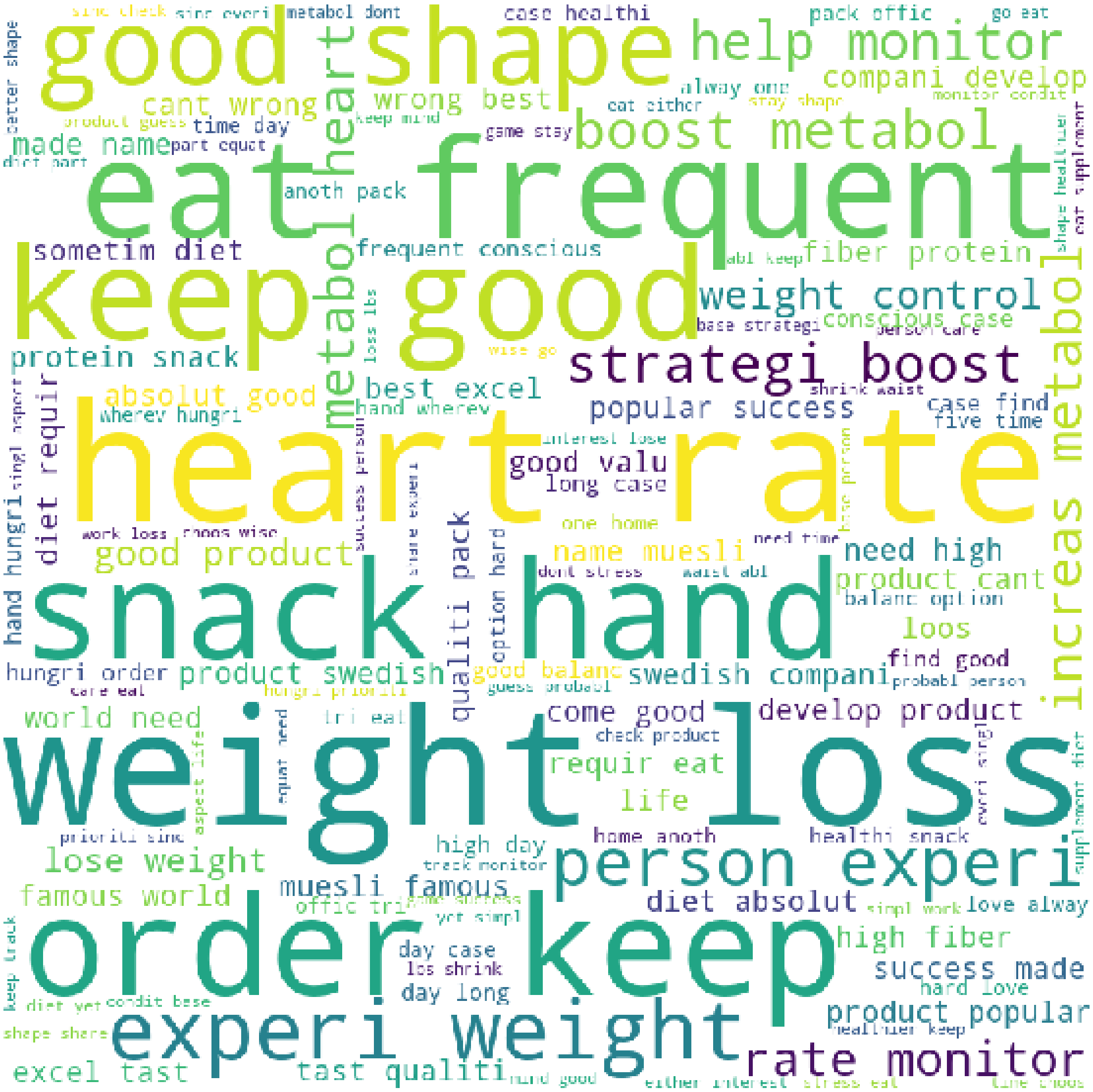
In [402]:

```
print(np.shape(clean_text_all_avgw2v))
```

```
(2, 5)
```

In [400]:
```
wordcloud_print(clean_text_all_avgw2v)
```





Applying DBSCAN on tfidf-W-W2V

In [403]:
```
clf_dbs_1_tfidfww2v = DBSCAN(eps=3)
labels_tfidfww2v_e1 = clf_dbs_1_tfidfww2v.fit_predict(train_tfidfww2v_1,y_train_
```

In [404]:

```
print(type(labels_tfidfww2v_e1))
labels_tfidfww2v_e1_df = pd.DataFrame(labels_tfidfww2v_e1)
print(type(labels_tfidfww2v_e1_df))

#matching the number of rows
final3 = final2[0:5000]
print(type(final3))
print(final3.shape)
#final3

#adding the values of labels in the data frame
final4 = final3
print(type(final4))
final4.reindex(columns=[*final4.columns.tolist(), 'labels'],fill_value=1)
final4['labels']=labels_tfidfww2v_e1_df.values

n_clusters_ = len(set(labels_tfidfww2v_e1)) - (1 if -1 in labels_tfidfww2v_e1 els
print ("No. of clusters formed = ",n_clusters_)

final4
```

```
<class 'numpy.ndarray'>
<class 'pandas.core.frame.DataFrame'>
<class 'pandas.core.frame.DataFrame'>
(5000, 11)
<class 'pandas.core.frame.DataFrame'>
No. of clusters formed =  1
```

In [405]:

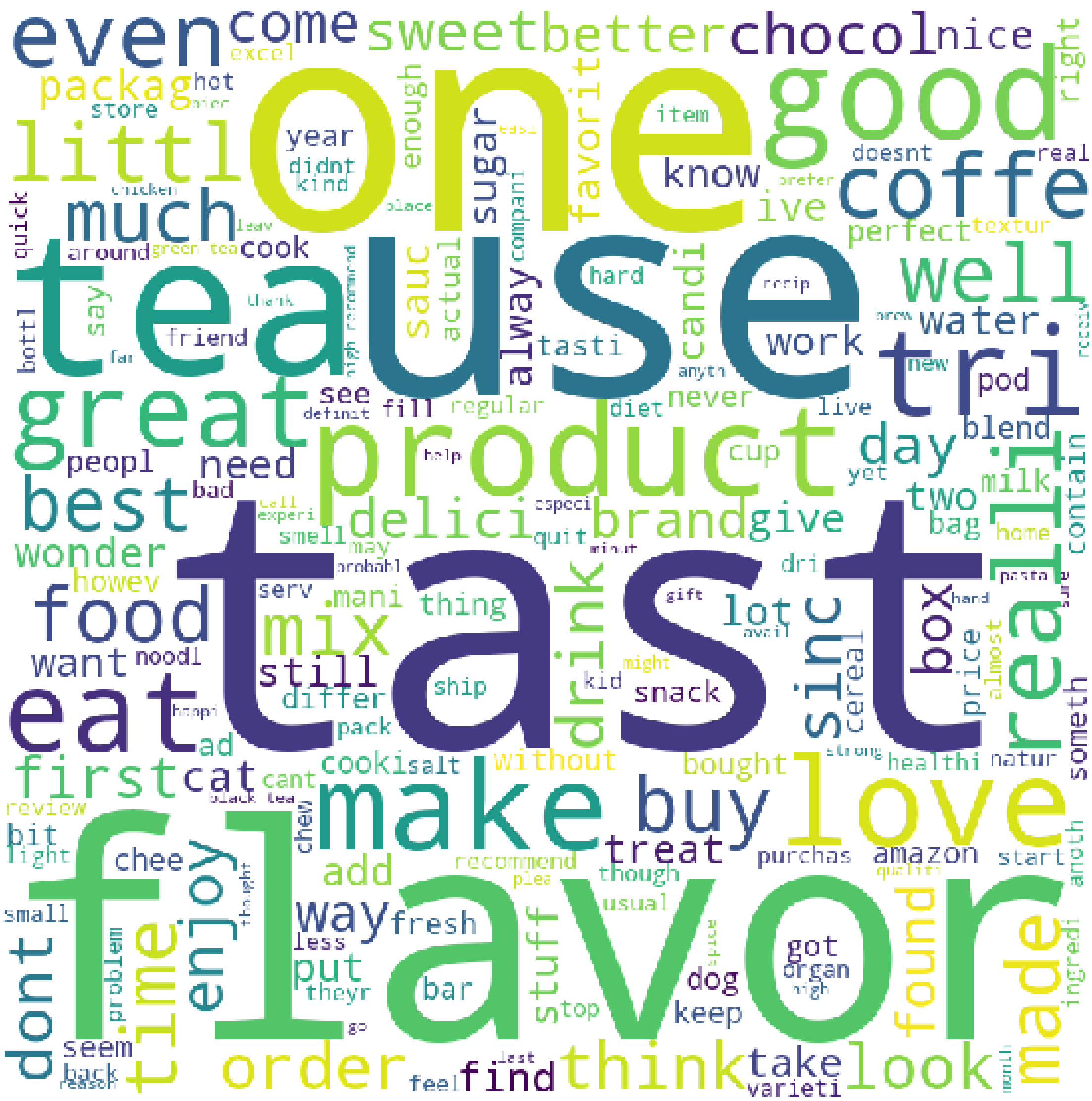
```
clean_text_all_tfidfww2v = list()

#copying all the data rows with label=0
clean_text_cat_0 = list()
for loop1 in range(0,5000):
    if (((final4['labels'].values)[loop1]) == 0):
        clean_text_cat_0.append(((final4['CleanedText'].values)[loop1]))
clean_text_all_tfidfww2v.append(clean_text_cat_0)
```

In [407]:

```
print(np.shape(clean_text_all_tfidfww2v))
```

```
(1, 4457)
```

In [408]:
```
wordcloud_print(clean_text_all_tfidfww2v)
```



In [410]:
```
clf_dbs_2_tfidfww2v = DBSCAN(eps=2)
labels_tfidfww2v_e2 = clf_dbs_2_tfidfww2v.fit_predict(train_tfidfww2v_1,y_train_
```

In [411]:

```
print(type(labels_tfidfww2v_e2))
labels_tfidfww2v_e2_df = pd.DataFrame(labels_tfidfww2v_e2)
print(type(labels_tfidfww2v_e2_df))

#matching the number of rows
final3 = final2[0:5000]
print(type(final3))
print(final3.shape)
#final3

#adding the values of labels in the data frame
final4 = final3
print(type(final4))
final4.reindex(columns=[*final4.columns.tolist(), 'labels'],fill_value=1)
final4['labels']=labels_tfidfww2v_e2_df.values

n_clusters_ = len(set(labels_tfidfww2v_e2)) - (1 if -1 in labels_tfidfww2v_e2 el
print ("No. of clusters formed = ",n_clusters_)

final4
```

```
<class 'numpy.ndarray'>
<class 'pandas.core.frame.DataFrame'>
<class 'pandas.core.frame.DataFrame'>
(5000, 11)
<class 'pandas.core.frame.DataFrame'>
No. of clusters formed =  12
```

In [412]:

```
clean_text_all_tfidfww2v = list()

#copying all the data rows with label=0
clean_text_cat_0 = list()
for loop1 in range(0,5000):
    if (((final4['labels'].values)[loop1]) == 0):
        clean_text_cat_0.append(((final4['CleanedText'].values)[loop1]))
clean_text_all_tfidfww2v.append(clean_text_cat_0)

#copying all the data rows with label=1
clean_text_cat_1 = list()
for loop1 in range(0,5000):
    if (((final4['labels'].values)[loop1]) == 1):
        clean_text_cat_1.append(((final4['CleanedText'].values)[loop1]))
clean_text_all_tfidfww2v.append(clean_text_cat_1)

#copying all the data rows with label=2
clean_text_cat_2 = list()
for loop1 in range(0,5000):
    if (((final4['labels'].values)[loop1]) == 2):
        clean_text_cat_2.append(((final4['CleanedText'].values)[loop1]))
clean_text_all_tfidfww2v.append(clean_text_cat_2)

#copying all the data rows with label=3
clean_text_cat_3 = list()
for loop1 in range(0,5000):
    if (((final4['labels'].values)[loop1]) == 3):
        clean_text_cat_3.append(((final4['CleanedText'].values)[loop1]))
clean_text_all_tfidfww2v.append(clean_text_cat_3)

#copying all the data rows with label=4
clean_text_cat_4 = list()
for loop1 in range(0,5000):
    if (((final4['labels'].values)[loop1]) == 4):
        clean_text_cat_4.append(((final4['CleanedText'].values)[loop1]))
clean_text_all_tfidfww2v.append(clean_text_cat_4)

#copying all the data rows with label=5
clean_text_cat_5 = list()
for loop1 in range(0,5000):
    if (((final4['labels'].values)[loop1]) == 5):
        clean_text_cat_5.append(((final4['CleanedText'].values)[loop1]))
clean_text_all_tfidfww2v.append(clean_text_cat_5)

#copying all the data rows with label=6
clean_text_cat_6 = list()
for loop1 in range(0,5000):
    if (((final4['labels'].values)[loop1]) == 6):
        clean_text_cat_6.append(((final4['CleanedText'].values)[loop1]))
clean_text_all_tfidfww2v.append(clean_text_cat_6)

#copying all the data rows with label=7
clean_text_cat_7 = list()
for loop1 in range(0,5000):
    if (((final4['labels'].values)[loop1]) == 7):
        clean_text_cat_7.append(((final4['CleanedText'].values)[loop1]))
```

```
clean_text_all_tfidfww2v.append(clean_text_cat_7)

#copying all the data rows with label=8
clean_text_cat_8 = list()
for loop1 in range(0,5000):
    if (((final4['labels'].values)[loop1]) == 8):
        clean_text_cat_8.append(((final4['CleanedText'].values)[loop1]))
clean_text_all_tfidfww2v.append(clean_text_cat_8)

#copying all the data rows with label=9
clean_text_cat_9 = list()
for loop1 in range(0,5000):
    if (((final4['labels'].values)[loop1]) == 9):
        clean_text_cat_9.append(((final4['CleanedText'].values)[loop1]))
clean_text_all_tfidfww2v.append(clean_text_cat_9)

#copying all the data rows with label=10
clean_text_cat_10 = list()
for loop1 in range(0,5000):
    if (((final4['labels'].values)[loop1]) == 10):
        clean_text_cat_10.append(((final4['CleanedText'].values)[loop1]))
clean_text_all_tfidfww2v.append(clean_text_cat_10)

#copying all the data rows with label=11
clean_text_cat_11 = list()
for loop1 in range(0,5000):
    if (((final4['labels'].values)[loop1]) == 11):
        clean_text_cat_11.append(((final4['CleanedText'].values)[loop1]))
clean_text_all_tfidfww2v.append(clean_text_cat_11)
```

In [413]:

```
print(np.shape(clean_text_all_tfidfww2v))
```

```
(12,)
```

In [414]:

```
wordcloud_print(clean_text_all_tfidfww2v)
```

In [415]:

```
clf_dbs_3_tfidfww2v = DBSCAN(eps=1)
labels_tfidfww2v_e3 = clf_dbs_3_tfidfww2v.fit_predict(train_tfidfww2v_1,y_train_1
```

In [416]:

```
print(type(labels_tfidfww2v_e3))
labels_tfidfww2v_e3_df = pd.DataFrame(labels_tfidfww2v_e3)
print(type(labels_tfidfww2v_e3_df))

#matching the number of rows
final3 = final2[0:5000]
print(type(final3))
print(final3.shape)
#final3

#adding the values of labels in the data frame
final4 = final3
print(type(final4))
final4.reindex(columns=[*final4.columns.tolist(), 'labels'],fill_value=1)
final4['labels']=labels_tfidfww2v_e3_df.values

n_clusters_ = len(set(labels_tfidfww2v_e3)) - (1 if -1 in labels_tfidfww2v_e3 els
print ("No. of clusters formed = ",n_clusters_)

final4
```

```
<class 'numpy.ndarray'>
<class 'pandas.core.frame.DataFrame'>
<class 'pandas.core.frame.DataFrame'>
(5000, 11)
<class 'pandas.core.frame.DataFrame'>
No. of clusters formed =  8
```

In [417]:

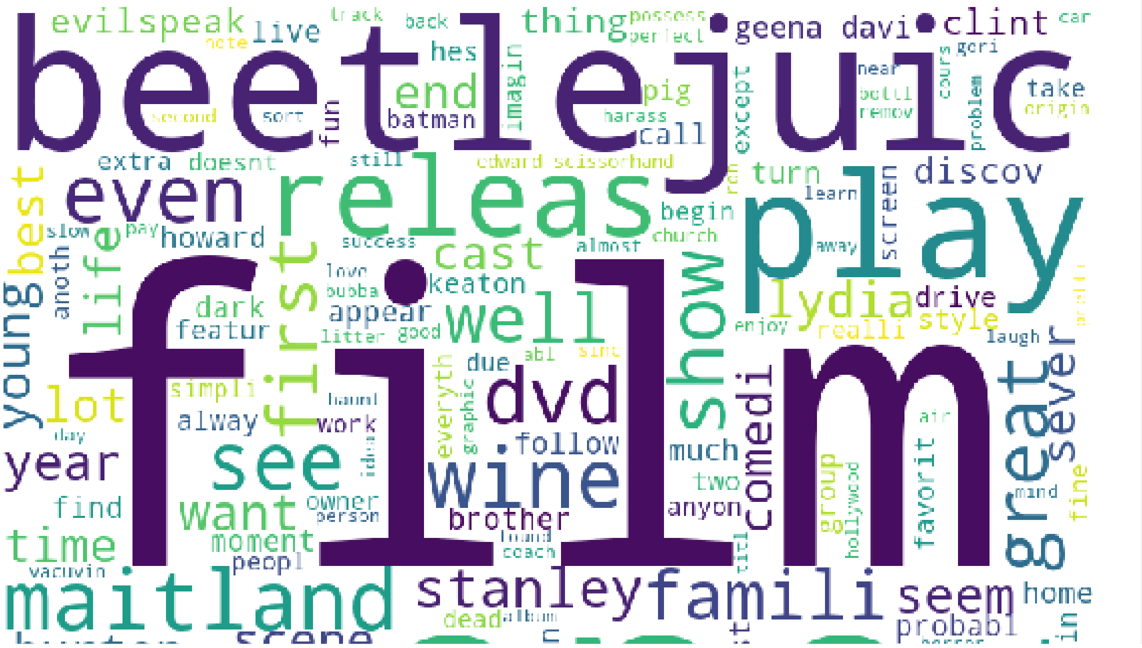
```
clean_text_all_tfidfww2v = list()

#copying all the data rows with label=0
clean_text_cat_0 = list()
for loop1 in range(0,5000):
    if (((final4['labels'].values)[loop1]) == 0):
        clean_text_cat_0.append(((final4['CleanedText'].values)[loop1]))
clean_text_all_tfidfww2v.append(clean_text_cat_0)

#copying all the data rows with label=1
clean_text_cat_1 = list()
for loop1 in range(0,5000):
    if (((final4['labels'].values)[loop1]) == 1):
        clean_text_cat_1.append(((final4['CleanedText'].values)[loop1]))
clean_text_all_tfidfww2v.append(clean_text_cat_1)

#copying all the data rows with label=2
clean_text_cat_2 = list()
for loop1 in range(0,5000):
    if (((final4['labels'].values)[loop1]) == 2):
        clean_text_cat_2.append(((final4['CleanedText'].values)[loop1]))
clean_text_all_tfidfww2v.append(clean_text_cat_2)

#copying all the data rows with label=3
clean_text_cat_3 = list()
for loop1 in range(0,5000):
    if (((final4['labels'].values)[loop1]) == 3):
        clean_text_cat_3.append(((final4['CleanedText'].values)[loop1]))
clean_text_all_tfidfww2v.append(clean_text_cat_3)

#copying all the data rows with label=4
clean_text_cat_4 = list()
for loop1 in range(0,5000):
    if (((final4['labels'].values)[loop1]) == 4):
        clean_text_cat_4.append(((final4['CleanedText'].values)[loop1]))
clean_text_all_tfidfww2v.append(clean_text_cat_4)

#copying all the data rows with label=5
clean_text_cat_5 = list()
for loop1 in range(0,5000):
    if (((final4['labels'].values)[loop1]) == 5):
        clean_text_cat_5.append(((final4['CleanedText'].values)[loop1]))
clean_text_all_tfidfww2v.append(clean_text_cat_5)

#copying all the data rows with label=6
clean_text_cat_6 = list()
for loop1 in range(0,5000):
    if (((final4['labels'].values)[loop1]) == 6):
        clean_text_cat_6.append(((final4['CleanedText'].values)[loop1]))
clean_text_all_tfidfww2v.append(clean_text_cat_6)

#copying all the data rows with label=7
clean_text_cat_7 = list()
for loop1 in range(0,5000):
    if (((final4['labels'].values)[loop1]) == 7):
        clean_text_cat_7.append(((final4['CleanedText'].values)[loop1]))
```

```
clean_text_all_tfidfww2v.append(clean_text_cat_7)
```

In [418]:
```
print(np.shape(clean_text_all_tfidfww2v))
```

```
(8,)
```

In [419]:
```
wordcloud_print(clean_text_all_tfidfww2v)
```



In [420]:
```
clf_dbs_4_tfidfww2v = DBSCAN(eps=0.5)
labels_tfidfww2v_e4 = clf_dbs_4_tfidfww2v.fit_predict(train_tfidfww2v_1,y_train_
```

In [421]:

```
print(type(labels_tfidfww2v_e4))
labels_tfidfww2v_e4_df = pd.DataFrame(labels_tfidfww2v_e4)
print(type(labels_tfidfww2v_e4_df))

#matching the number of rows
final3 = final2[0:5000]
print(type(final3))
print(final3.shape)
#final3

#adding the values of labels in the data frame
final4 = final3
print(type(final4))
final4.reindex(columns=[*final4.columns.tolist(), 'labels'],fill_value=1)
final4['labels']=labels_tfidfww2v_e4_df.values

n_clusters_ = len(set(labels_tfidfww2v_e4)) - (1 if -1 in labels_tfidfww2v_e4 els
print ("No. of clusters formed = ",n_clusters_)

final4
```

```
<class 'numpy.ndarray'>
<class 'pandas.core.frame.DataFrame'>
<class 'pandas.core.frame.DataFrame'>
(5000, 11)
<class 'pandas.core.frame.DataFrame'>
No. of clusters formed =  2
```

In [422]:

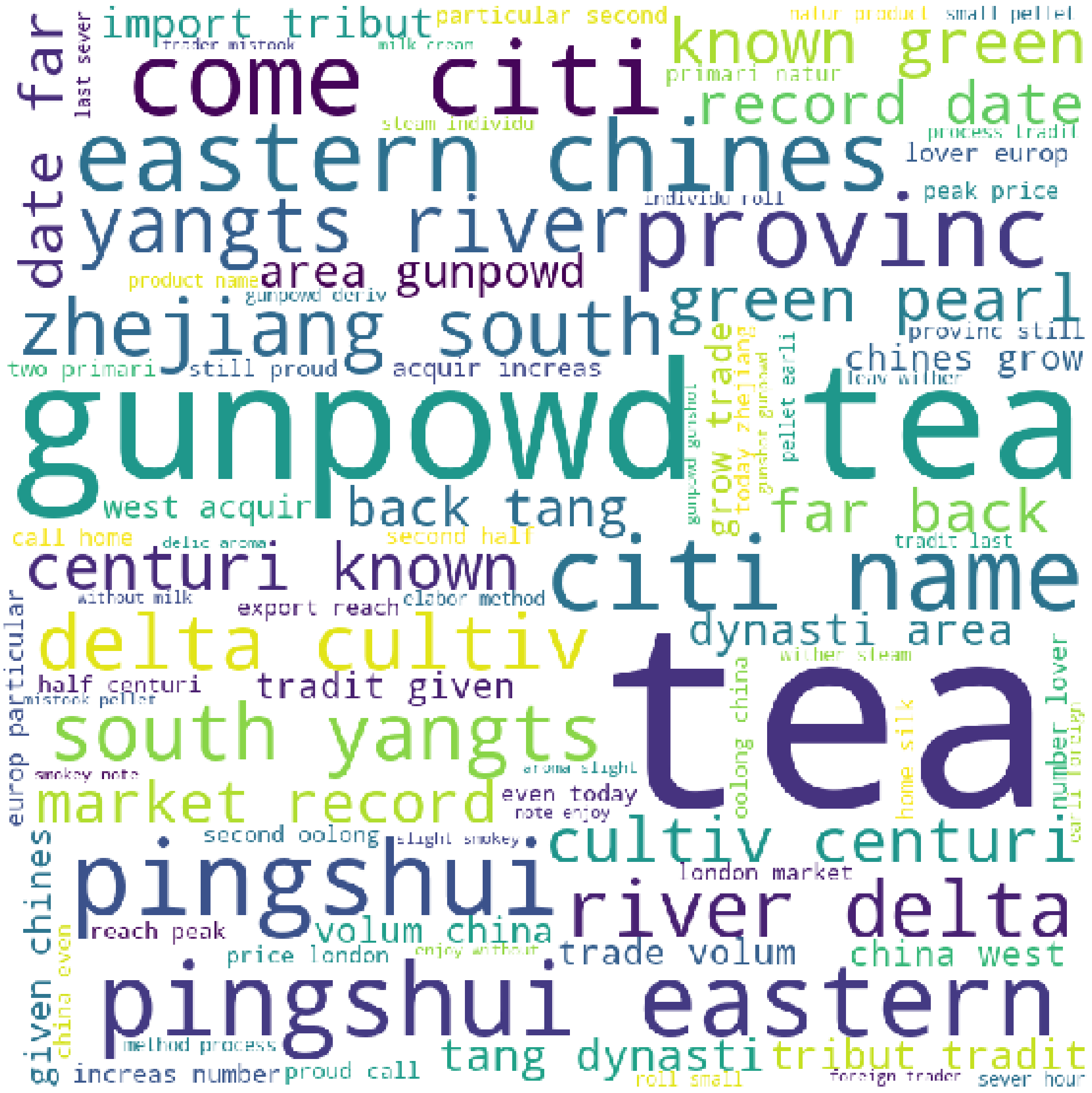
```
clean_text_all_tfidfww2v = list()

#copying all the data rows with label=0
clean_text_cat_0 = list()
for loop1 in range(0,5000):
    if (((final4['labels'].values)[loop1]) == 0):
        clean_text_cat_0.append(((final4['CleanedText'].values)[loop1]))
clean_text_all_tfidfww2v.append(clean_text_cat_0)

#copying all the data rows with label=1
clean_text_cat_1 = list()
for loop1 in range(0,5000):
    if (((final4['labels'].values)[loop1]) == 1):
        clean_text_cat_1.append(((final4['CleanedText'].values)[loop1]))
clean_text_all_tfidfww2v.append(clean_text_cat_1)
```

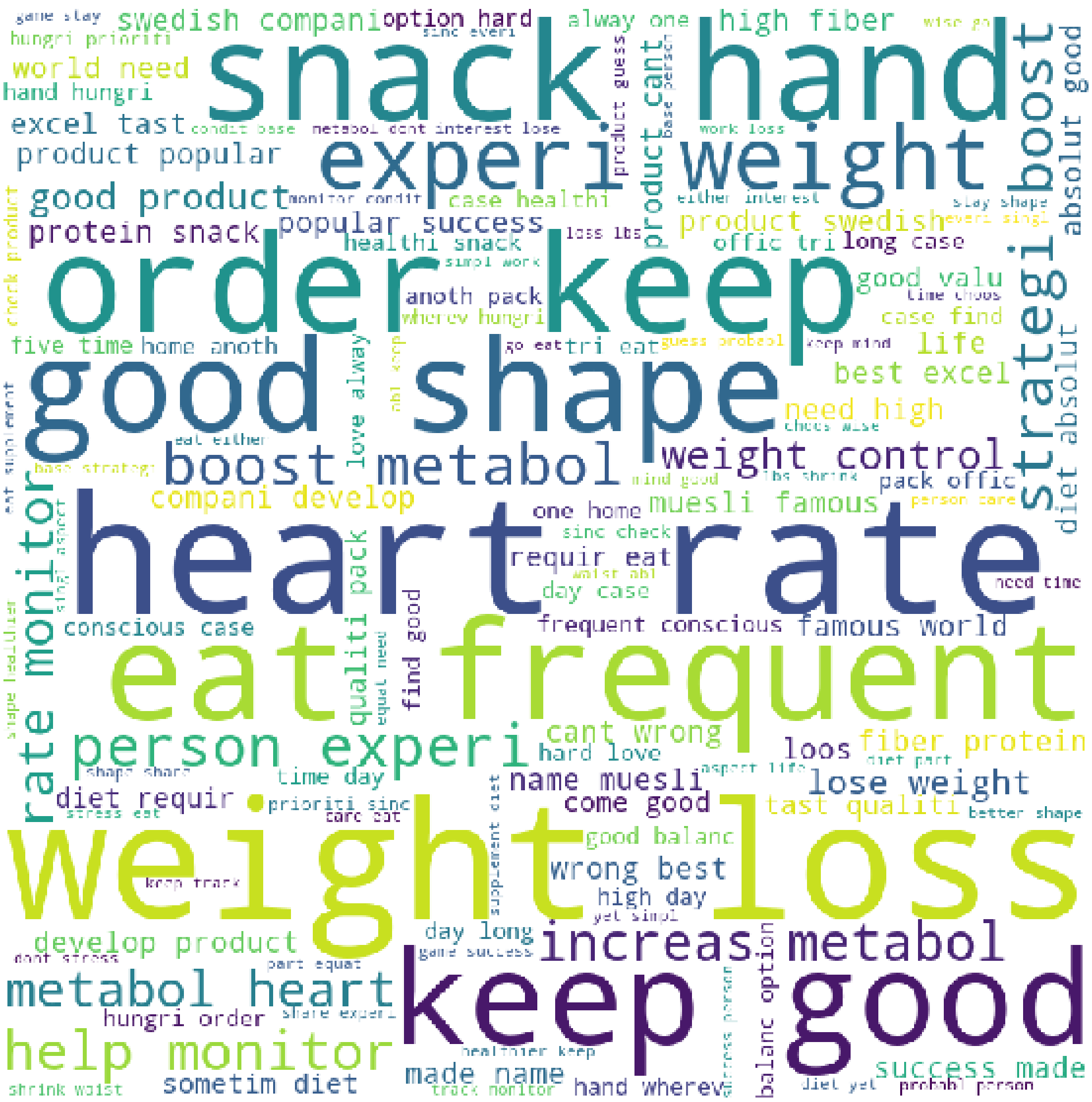
In [423]:

```
print(np.shape(clean_text_all_tfidfww2v))
```

```
(2, 5)
```

```
In [424]: wordcloud_print(clean_text_all_tfidfww2v)
```




snack hand
order keep
good shape
heart rate
eat frequent
weight loss
keep good
experi weight
boost metabol
strategi boost
person experi
rate monitor
metabol heart
help monitor
increas metabol
weight control
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high fiber
world need
excel tast
product popular
good product
protein snack
popular success
product swedish
compani develop
muesli famous
famous world
lose weight
fiber protein
develop product
name muesli
come good
tast qualiti
wrong best
high day
cant wrong
sometim diet
made name
success made
hand wherev
diet requir
conscious case
frequent conscious
requir eat
best excel
need high
good valu
life
case find
anoth pack
five time
home anoth
healthi snack
offic tri
long case
pack offic
one home
absolut good
diet absolut
qualiti pack
love alway
find good
balanc option
option hard
alway one
hand hungri
hungri order
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day case
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loos

In [425]:

```
x = PrettyTable()
x.field_names = ["Paramters/Models","BoW", "TFIDF", "AvgW2V", "TFIDF-W-W2V"]

x.add_row(["No. of clusters(best)(KMeans) : ","6","6","6","6" ])
x.add_row(["No. of clusters(taken)(Aggloremative): ", "-","-","2,3,4,5","2,3,4,5
x.add_row(["No. of clusters(eps=3)(DBSCAN): ", "-", "-", "1", "1" ])
x.add_row(["No. of clusters(eps=2)(DBSCAN): ", "-", "-", "12", "12" ])
x.add_row(["No. of clusters(eps=1)(DBSCAN): ", "-", "-", "8","8" ])
x.add_row(["No. of clusters(eps=0.5)(DBSCAN): ", "-", "-", "2", "2" ])

print(x)
```

```
+-----------------------------------------+-----+-------+---------+------------
-+
|             Paramters/Models            | BoW | TFIDF |  AvgW2V | TFIDF-W-W2V
|
+-----------------------------------------+-----+-------+---------+------------
-+
|     No. of clusters(best)(KMeans) :     |  6  |   6   |    6    |      6
|
| No. of clusters(taken)(Aggloremative):  |  -  |   -   | 2,3,4,5 |   2,3,4,5
|
|     No. of clusters(eps=3)(DBSCAN):     |  -  |   -   |    1    |      1
|
|     No. of clusters(eps=2)(DBSCAN):     |  -  |   -   |    12   |      12
|
|     No. of clusters(eps=1)(DBSCAN):     |  -  |   -   |    8    |      8
|
|    No. of clusters(eps=0.5)(DBSCAN):    |  -  |   -   |    2    |      2
|
+-----------------------------------------+-----+-------+---------+------------
-+
```

In [ ]: